the OIL AND GAS JOURNAL
PUBLISHED WEEKLY MAY 30, 1960

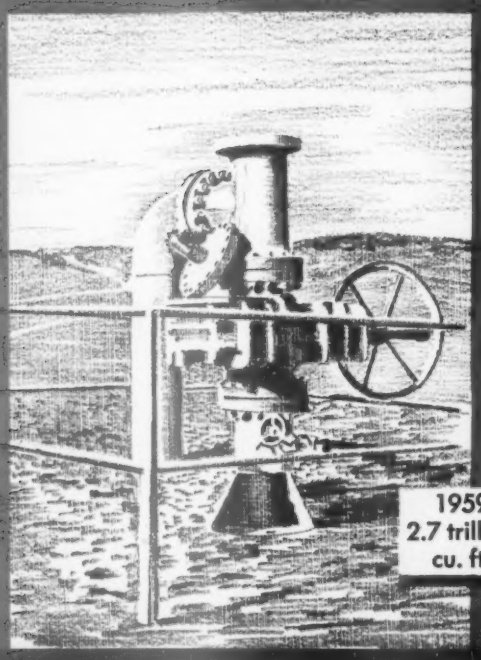
Appalachians coming alive again ▸ 54

Washington growing as "oil center" ▸ 62

Soviet oil for Cuban refineries? ▸ 71

East Texas fire flood successful ▸ 102

Wyoming action sets fast pace ▸ 132



1959: 2.7 trillion cu. ft.

3 1960: trillion cu. ft.

Underground natural-gas storage still climbing

Journal survey shows 12% gain over last year's figures

p. 89

NOW, YOU CAN MAKE YOUR XMAS TREES SAFER THAN EVER!

The New Unibolt Pressurematic Wing Valve

- ***Automatically shuts in the well when flowline pressures rise or fall beyond desired limits.***
- ***Permits manual operation for choke changing.***

A broken flowline or the failure of any unit in the separator, heater-treater, or gathering manifold that would cause the flowline pressure to *drop*, would automatically and instantly close the Pressurematic Wing Valve and shut in the well. Any obstruction in the flowline, such as paraffin, that would cause the flowline pressure to *rise*, would also actuate the Pressurematic Valve to closed position.

CONVERT your standard Unibolt Wing Valves to PRESSUREMATICS by simply replacing the bonnet assembly with the new Pressurematic unit.

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Complete details will gladly be sent on request.

THORNHILL UNIBOLT **CRAVER CO.**

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OIL AND GAS JOURNAL
Vol. 58, No. 22

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TECHNOLOGY—OPERATION

Pipelining

Tapline's Experience with Gas Turbines 77

By R. C. Hill, R. H. Hubbell, and H. L. Krapp

Two years' operating experience with these units shows that maintenance problems have been severe. However, these are being overcome and the basic concept of remotely controlled gas-turbine pumping units is believed sound. Unit availability is high.

Pipeline Construction Report 111

Refining

How Refiners Battled Gas-Turbine Problems 87

Early bugs in these units have been worked out by solving the problems of severe blade damage due to sulfur in the fuel gas, carbon deposits on burner nozzles, thrust-bearing failure caused by loss of lubricating oil, and power loss caused by high ambient temperature and fouling.

How Refiners Have Solved Some Asphalt Problems 97

By C. W. Berger

Asphalt blending plus the use of chemical modifiers will help to improve asphalt quality. But more thorough laboratory analysis of the heavier bituminous materials will give a better basis for the most likely blending.

Process Costimating—72 109

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Drilling-Production

Maintaining Low-Solids Drilling Fluids 81

By Arthur Park, P. P. Scott, Jr., and J. L. Lummus

A new powdered free-flowing polymer to replace part of the bentonite in a drilling mud can speed up drilling rate. A further aid in keeping solids content low is a new design of cyclone separator for the mud.

East Texas' First Fire Flood Is Successful 102

By P. D. White and J. T. Moss

The Carrizo-Wilcox zone in East Texas is extremely susceptible to combustion. Efficiency in the test is higher than any previously reported in the literature. There is no evidence of excessive corrosion. Sand control is a problem at the greatly accelerated production rate.

Reservoir Engineering—23 98

By E. T. Guerrero and F. M. Stewart

How to compute an average-permeability-ratio curve for a lease or a reservoir, using individual sample curves.

SPECIAL REPORT: Natural-Gas-Storage Capacity Jumps 12% 89

By Robert B. Bizal

Industry now has 217 existing or planned storage areas in 22 states to take care of winter demand. More than 25 construction projects are under way, testing, or proposed.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
May 30, 1960

A look at Congress as it heads into home stretch shows:

Oil didn't gain much—nor suffer much—during the current session.

An omnibus mineral leasing bill will be passed. It will consolidate option and leasing limitations of federal acreage. Annual rentals will be increased to 50 cents an acre, with present second and third-year rental waivers out.

Minimum wage bill probably will be approved, hiking minimum to $1.15 an hour, with the increase from the present $1 spread out over 3 years. Coverage also will be extended. Application to oil wholesaling and retailing still in doubt.

Corporate taxes will be extended at present rate. Effort will be made on Senate floor to tie in a cut in percentage depletion, but this will fail.

Fuel policy study proposals likely will be shelved, and fair trade bill probably will fail too.

Bills affecting TBA marketing practices, introduced by Rep. James Roosevelt, won't get off the ground, although hearings on a TBA divorcement bill will be held June 15 by House interstate commerce subcommittee.

Other aspects of current session:

Hearings on percentage depletion last winter probably helped industry more than they hurt. Same is true of Roosevelt's hearing on charges that majors "coerce" service station outlets.

Hearings on pipeline company "influence" at FPC fizzled but may have caused some public-opinion damage.

▼ ▼ ▼

Rig activity has reached a high for the year.

The 1,989 rigs busy last week were 83 more than had work the week before, but still 302 below the 2,197 working at this time a year ago.

Oklahoma and Kansas accounted for much of last week's increase—16 more rigs operating in Kansas, 22 in Oklahoma. Other gains were made in Louisiana, Mississippi, New Mexico, North Dakota, and Utah (p. 152)*.

Well completions tell the drilling story. Total last week was 841 wells, a decline of 93 from the week before. Completions for the year are 16,347 compared to 18,937 at this time a year ago.

Exploration notes:

Mobil has started first wildcat on 36,000-acre lease in the Gulf for which it recently paid $24 million.

New oil pay, the St. Peter sand, is indicated for Kentucky in the Neely 1 Lyle wildcat in Estill County in eastern part of state.

Trenton Ordovician strikes are in the news at Woodruff-Jenkins 1 Parson in Indiana just south of the Michigan line, at Fulk 1 Ripley in Calhoun County, Michigan, and at the 1 McMaster in Oxford County, Ontario, 150 miles from Colchester field.

Oklahoma's Kingfisher County has a hot record so far this year—18 field-development wells completed for 100% success ratio, 7 hits out of 8 wildcat trys tapping 6 new oil fields and a new gas field.

▼ ▼ ▼

The lease-back idea may now enter pipelining.

An Oklahoma leasing firm which heretofore has leased cars, trucks, tank cars, pumps, etc., to the oil industry is now considering building a pipeline for lease.

The crude line would be built to specifications of the lessee, an Oklahoma crude company. The lessee would operate the line under a long-term contract. It's all in the talking stage now, but reports are it has a good chance of coming off.

New underground storage capacity for gas has climbed 12% since last year and has nearly doubled in 5 years.

Annual Journal survey reports capacity will be 3.03 trillion cubic feet when projects now under way or planned are completed. Capacity was 2.7 trillion cubic feet last year (p. 89).

Interprovincial Pipe Line is entering the race to provide transportation of surplus natural-gas liquids from Alberta to Great Lakes and eastern markets.

Rising gas exports to U. S. will result in about 100,000 bbl. daily of surplus products by 1962.

Interprovincial President T. S. Johnston says his firm will be prepared to move these products through its 2,000-mile Edmonton-Toronto crude system which cuts through the U. S. Great Lakes area. Pembina Pipe Line is trying also to promote a 1,300-mile 16-in. line costing $150 million from Alberta to Chicago (OGJ, April 11, p. 83).

Steady progress is being made in gas pipeline automation (p. 59).

Witness Colorado Interstate, which has the latest in push-button operation of gas lines, it claims nation's first remotely supervised automatic station.

Independents in prorating states are collecting data on crude purchasing which they hope will persuade oil men in non-prorating states to push for proration laws.

The independents are getting information on what they feel are crude-buying abuses by major buyers, especially in some Rocky Mountain states. Work is being done by a subcommittee of the Liaison Committee of Cooperating Associations. This is an organization of local or regional producer groups, set up initially to fight for curbs on imports.

Heading the subcommittee is Tom Schwinn, Wichita; and serving with him are W. N. Tindle of Abilene, Tex., Paul Schultz of Tulsa, R. J. Leonard of Roswell, and Harold McClure of Alma, Mich.

Wider significance is being given to the upcoming important hearing in Austin on how Texas should distribute allowable to future artificial recovery projects.

Railroad Commission has broadened scope of the hearing to include whether MER's of both future and existing fields should be restricted to allowables granted by the state's depth yardstick.

Some operators complain that newer fields aren't getting a fair allowable shake. They contend newer fields are held to the yardstick even when they can show adequate proof of more capacity without waste. But older fields that were granted higher MER's back when demand was greater are still producing at these high rates.

▼ ▼ ▼

Humble has entered West Coast marketing in a small deal—but a larger one may be in the mill.

Humble acquired properties of Major Gas Stations, Inc., from Martin Steinberg and Jacob Kahn of Gardena, Calif. They involve 11 retail outlets in Los Angeles, 12 in Arizona, and 4 in Nevada—all cut-rate operations.

Humble reportedly is negotiating for purchase of Time Oil, a big-time West Coast jobber and retailer.

Russian shadow over world oil is growing:

...Fidel Castro's regime has told Cuban refiners—Esso, Texaco, Shell—they will be expected to process in their plants about 2,220,000 bbl. of Russian crude a year. Failure to cooperate will bring nationalization (p. 71).

...Major strike in Afghanistan made by Soviet technicians and equipment is being claimed by Moscow (p. 76).

...Toehold in Ethiopia has been gained by Russians who have lent money for new refinery in return for supply contract and control over country's marketing.

...New Cambay strike in India, hailed as nation's best, has been made with Soviet drilling equipment (p. 72).

Market Memo

May 30, 1960

Refiners are acting like alcoholics.

They reduce crude runs to stills for a few weeks then "fall off the wagon", go on a binge, ignore high inventories, and increase crude runs.

It is "incremental virus" again and a memorial to gross mismanagement in an oversupplied market.

Refiners added more products to storage last month than in any April in the past 12 years. Oversupply breeds contempt for prices.

A good omen: Major-company inquiries are in the market place for 91-93 RON gasoline. Those inquiring have concluded it's the better part of wisdom to cut runs and buy from surplus inventories carried by others.

Gasoline, out of Group 3 for northern shipment, posted at 10.5 cents per gallon for 91 RON, is being discounted by one-quarter cent in some areas. Inter-refinery sales can be made at one-half cent off posting.

There is no activity on middle distillate for movement out of Group 3 north. The No. 2 posted price of 7.75 cents per gallon is too low to stimulate selling interest.

In Chicago, the dust is believed settling. One-quarter cent discounting off posted prices for gasoline, No. 1, and No. 2 seems to be about the best a "shopping jobber" could do during the week just prior to Memorial Day. There are those who will discount only one-eighth cent off postings.

River gasoline continues to encounter difficulty getting into Chicago markets at competitive prices. Midriver markets on gasoline as well as on middle distillates are rather inactive.

Gasoline is being offered at three-eighths to one-half cent off Gulf Coast low from more than one midriver point.

The offerings of No. 2 range from one-quarter cent off Gulf Coast low to the low of 8 cents.

Gulf Coast prices are firming due to cargo purchases of gasoline, No. 2, and No. 6.

Spot cargo gasoline is firmer at one-quarter to one-half cent off posted prices, with the larger discounting being offered on premium grades.

No. 2 from the Gulf Coast, posted at 8 cents, is in a contraseasonally strong position due to volume cargo purchases. Even one-eighth cent off posted price for prompt No. 2 is difficult to locate.

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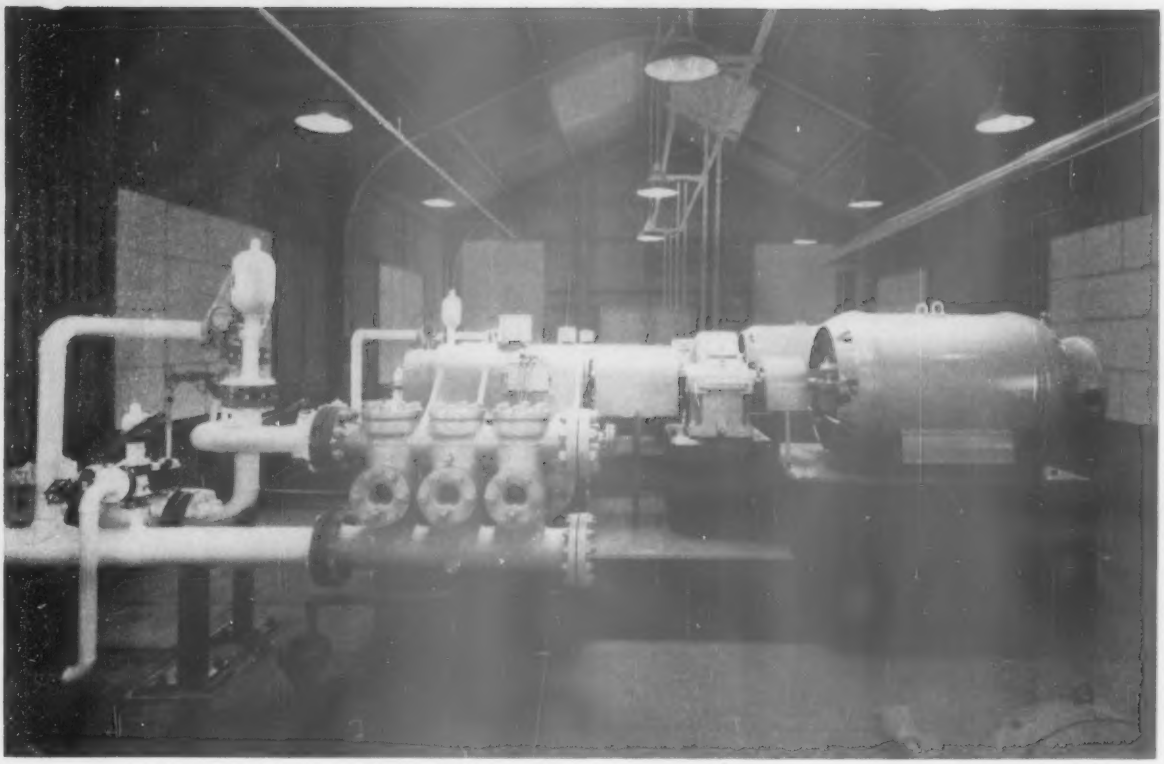

They're pumping products to market with these "Oilwell" Triplex Plunger Pumps

IN THIS PUMPING STATION, three "Oilwell" Triplex 358-P Plunger Pumps take care of the round-the-clock assignment of moving LPG from the field processing plant in New Mexico to marketing terminals in Utah.

Their horizontal design with (1) large power-end access covers, (2) outside access for bearing adjustments, (3) crosshead shoes, (4) two-piece plungers, (5) removable stuffing boxes, (6) screw-type glands, (7) interchangeable individually removable valves and (8) individual cylinder heads and valve covers; requires minimum attention and simplifies maintenance.

The 358-P fluid end accommodates a variety of plunger sizes and provides pressure-capacity selections covering a wide range of pumping requirements. The 368-P fluid end, which is fully interchangeable, extends capacities at reduced pressures.

USS and "Oilwell" are registered trademarks

Bring your pumping problems to "Oilwell" and let experienced sales engineers recommend the type and size pump to meet your exact requirements.

PERFORMANCE DATA

Plunger Size, Inches	Maximum Working Pressure (psi)	Normal Displacement Range Barrels per 24 hours at pump speeds (rpm) of:				
		100	125	150	175	200
358-P						
3½	2,410	2,950	3,680	4,430	5,160	5,890
3½	2,080	3,430	4,290	5,145	6,000	6,850
4	1,590	4,460	5,550	6,680	7,800	8,900
4½	1,260	5,655	7,060	8,460	9,900	11,300
5	1,020	7,000	8,740	10,500	12,230	13,970
368-P						
5½	840	8,435	10,540	12,650	14,750	16,840
6	710	10,075	12,590	15,100	17,630	20,600
6½	600	11,825	14,800	17,750	20,700	23,600
Brake Horsepower Required		133	166	200	232	266

Oil Well Supply Division of USS United States Steel

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This hose keeps the joints from jumping

B.F.Goodrich hose still on the job after 5 years and 52 wells

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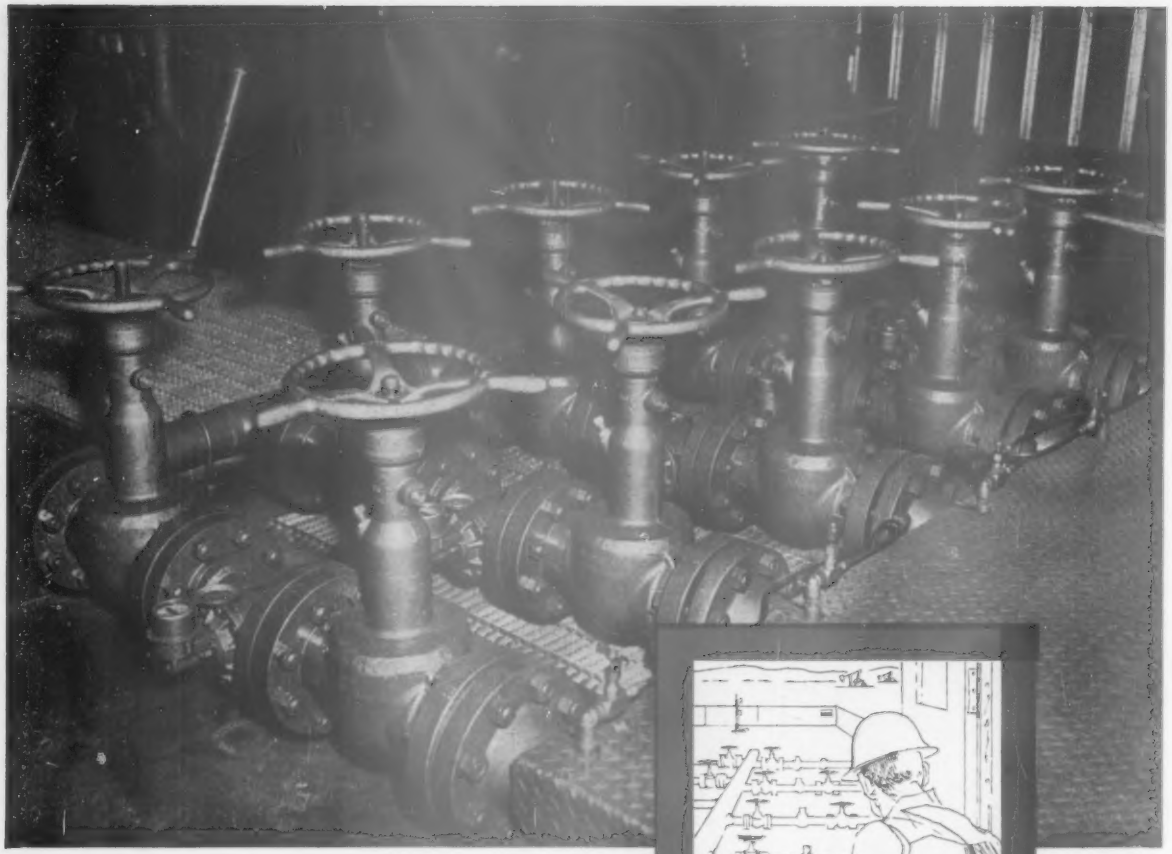
This hose was specially developed by B.F.Goodrich to keep the terrific vibration of the slush pump from shaking off connections. It's so flexible that it absorbs the destructive vibrations, can't be jarred loose—yet it's so tough it lasts for years. It can be loaded onto trucks, moved from job to job, dragged into position without fear of damage—the thick, tough rubber cover resists gouges, scrapes, tears. Sun, wind and rain won't weaken it. Spiral-wrapped cable wires make it resistant to bursts.

The tube of this B.F.Goodrich hose is smooth so mud can flow through at high speed without appreciable pressure drop. The tough rubber resists abrasion; oily mud will not cause it to swell or rot. Hose ends are reinforced to protect against bending stress at the couplings.

You'll find this longer-lasting B.F.Goodrich hose at leading supply stores in the oil fields, or at any of these B.F.Goodrich warehouses: Los Angeles, Great Bend, New Orleans, Hobbs, Oklahoma City, Tulsa, Dallas, Houston, Odessa, Wichita Falls. *B.F.Goodrich Industrial Products Co., Dept. M-810, Akron 18, Ohio.*

B.F.Goodrich



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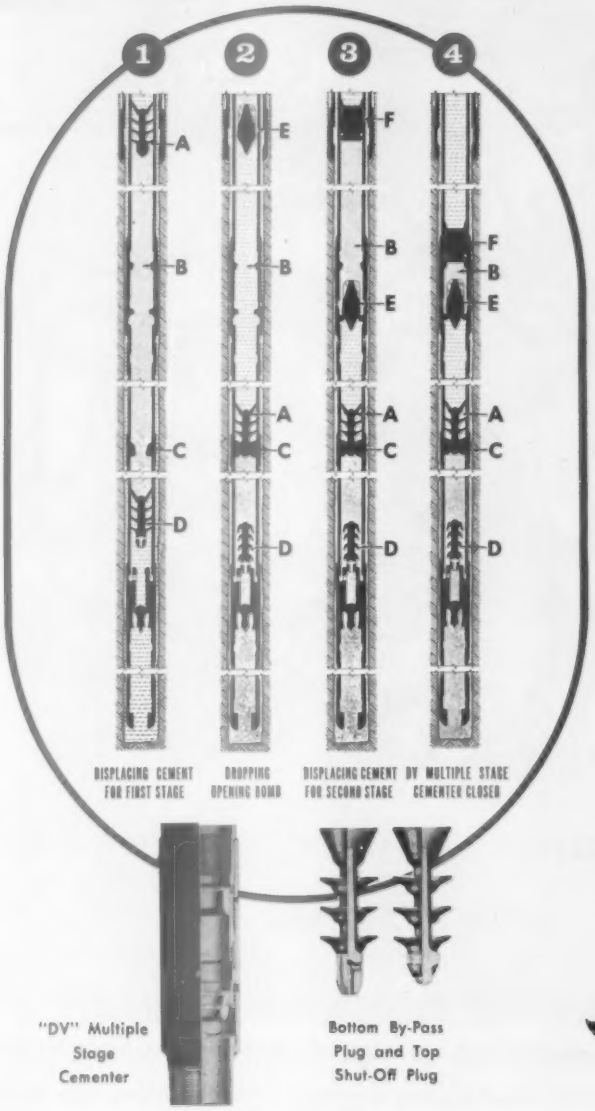
4 STEPS TO SUCCESS

IN MULTI-STAGE CEMENTING



If you've thought of multiple stage cementing only in connection with multi-zone completions, you may be missing many benefits that could be yours by using this system in conventional primary cementing. For instance,

DID YOU KNOW THAT MULTIPLE STAGE CEMENTING CAN HELP YOU . . .

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1 STEP ONE . . . Bottom By-Pass Plug (D) leads the cement, displacing well fluid ahead of it, and seats in the By-Pass Baffle located on top of the Super Seal Float Collar after passing through the "DV" tool (ports closed). Openings in the Bottom Plug allow passage of cement through the plug. Shut-Off Plug (A) follows cement and seats in its Baffle (C) to complete the first stage job.

2 STEP TWO . . . Opening Bomb (E) is dropped through casing and seats in "DV" tool (B). Pressure is applied, opening the "DV" cementing ports.

3 STEP THREE . . . Second stage cement is pumped down, followed by Closing Plug (F).

4 STEP FOUR . . . Displacing fluid pumped behind Closing Plug (F) moves the cement through the open ports in the "DV" tool until Closing Plug (F) is seated in top of the tool which closes the ports and completes the job.

"DV" MULTIPLE STAGE CEMENTER . . .

is hydraulically operated by pump pressure to open after passage of first stage cement and close at completion of second stage.

BOTTOM BY-PASS AND TOP SHUT-OFF PLUGS . . .

for first (lower) stage of job. Note openings in bottom plug to allow passage of cement through Float Collar and Guide Shoe.

Ask your nearby Halliburton Representative to explain how this experience can pay off for you.

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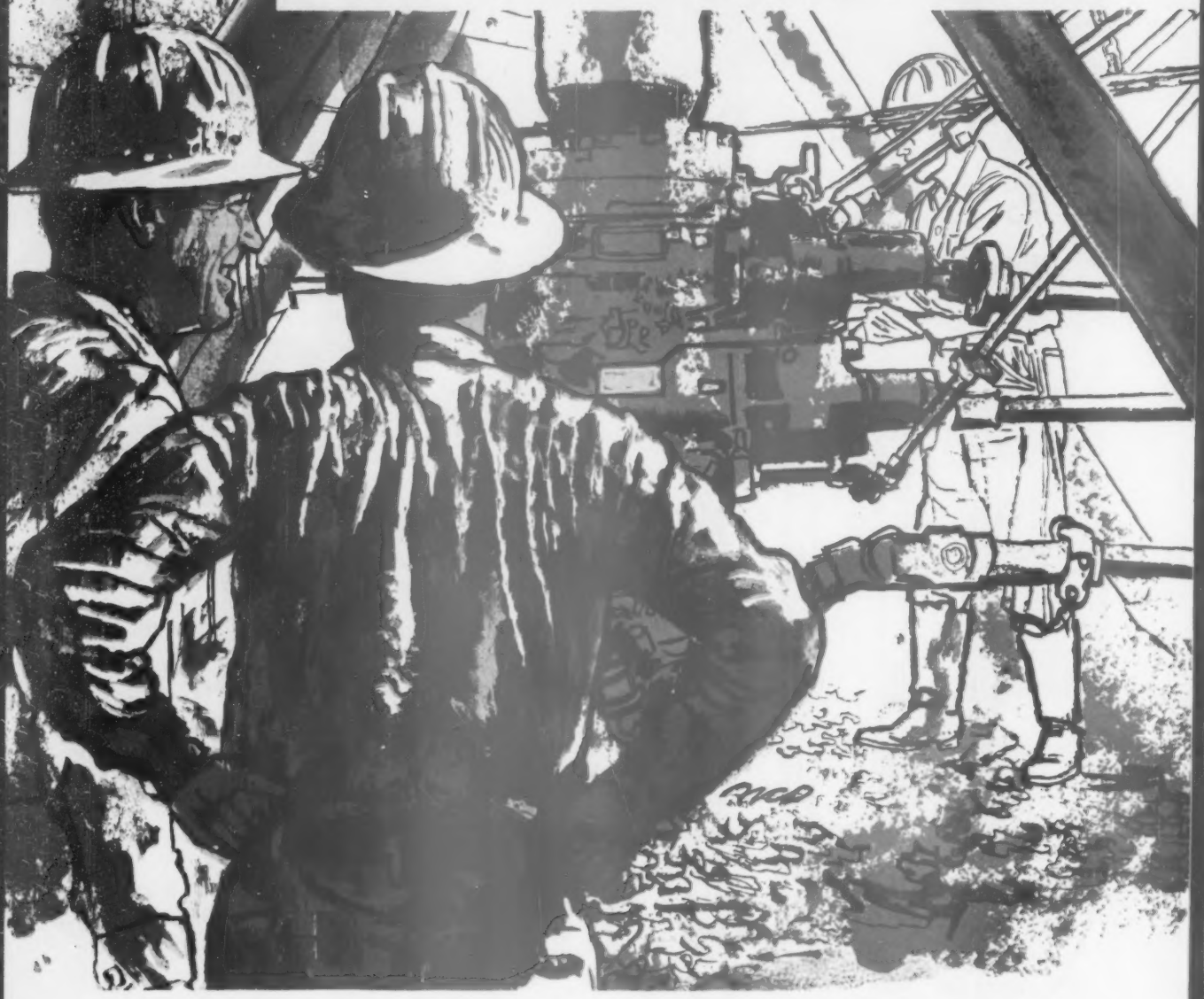
HALLIBURTON CEMENTING SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

How protection in depth helps cut compensation costs



How well are your men equipped to handle a blowout?

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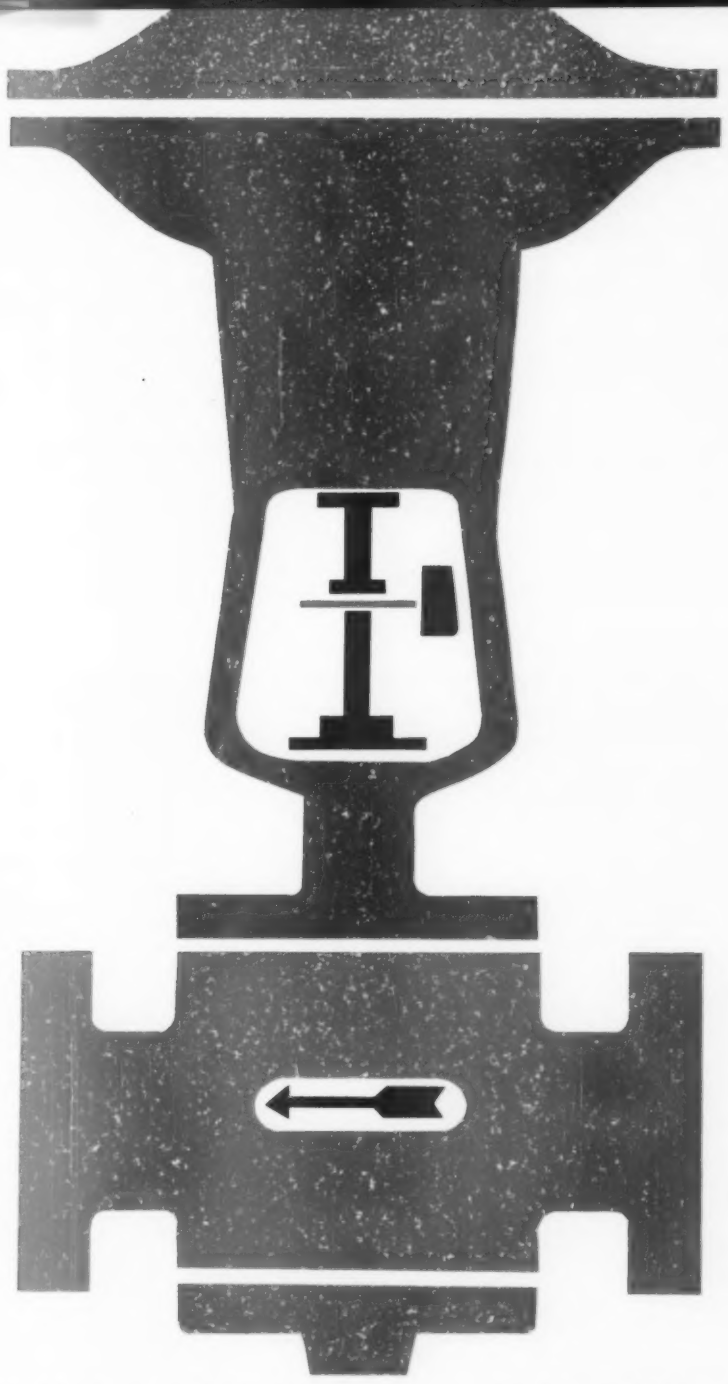

when you're considering control valves, it pays to look at the whole picture!

HONEYWELL

How do you buy control valves? On price? On the basis of quality of materials and craftsmanship? On flow capacity, sensitivity or other performance characteristics? Sure, these are all important considerations. But no one of them *alone* offers a sound basis for evaluating control valves. You should take into account all of these factors, and many more . . . the whole picture.

A control valve is more than just hardware. It's actually the payoff point of your process. That's why it pays to consider other Honeywell factors, beyond the valve itself—things like process control experience, application engineering, and installation and maintenance supervision. The "whole picture" approach rewards you with best possible valve performance and better processing, regardless of your application.

IF YOU'RE CONSIDERING CONTROL VALVES, STUDY THE HONEYWELL PICTURE FROM EVERY ANGLE . . . YOU'LL FIND IT A BRIGHT ONE.

here's how Honeywell brightens the

Honeywell puts 75 years of control experience to work for you

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Honeywell field engineers think in terms of the "whole picture"

Honeywell field men are more than just valve specialists. They're control engineers. Because they work with valves in their relation to the *overall* control system, they can help you get the very best from your entire system.

These eight control valves are representative of the broad Honeywell line.

Versatile, inexpensive . . . for general plant or process flows.

Self-contained, electric motor actuated . . . for plant service applications.

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control valve picture for you!

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Honeywell builds extra quality into control valves

Each Honeywell control valve is the product of first-rate materials, precision machining, careful assembly, and the most rigid testing and inspection imaginable. You can rely on them for long, low-maintenance service—and, for all their ruggedness, they're built to operate with the precision of a fine instrument.

Honeywell delivers on time

You'll like the completeness and "on-time" aspects of Honeywell service. Each order is double-checked against your final process requirements before it's shipped. Stocks of the most commonly used valves and parts are always kept on hand, ready to meet your deadlines.

Honeywell helps install and maintain your control valves

Your local Honeywell service engineer can lend you an experienced hand in installation and startup of your system. Honeywell control valves rarely require any more maintenance than an occasional check of the packing box. But should any trouble arise, a call to your Honeywell branch will bring help on the run.

Split-body simplifies maintenance in control of "problem" fluids.

Balanced, three-way operation . . . ideally suited to mixing or diverting.

Special features and accessories . . . for high temperatures and pressures.

Angle-body, electro-pneumatic positioning . . . exemplifies flow and control versatility.

75th YEAR

Honeywell

First in Control

SINCE 1885

we'd like to start working for you right now

HERE'S THE VERY FIRST STEP TOWARD BETTER CONTROL
Fill in this coupon and return it to Honeywell's Valve Division

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY
VALVE DIVISION, Fort Washington, Pa.

Please send catalog. I am interested in Control Valves for

_____

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

Put our team of experts to work on your control valve problems right away. You'll find that Honeywell's Valve Division is a reliable source of competent engineering assistance and excellent products. Tell us about your application today.

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY,
Valve Division, Fort Washington, Pa.

Honeywell

First in Control

SINCE 1885

We'll save $1,600.00 on this workover by using

OTIS TUBING SERVICE

...here's how!

We've got a 6,000-foot dual-producer here that is either leaking around the packer or has a hole in the tubing. At least something went wrong because we had a sudden pressure drop on the lower zone and an increase in pressure on the upper zone. In either event, we're going to have to pull the tubing. And, since we rely on Otis for help on almost all our downwell problems — such as completion techniques and equipment, sub-surface flow control, etc.— we naturally called them in on this job.

Otis' charges to round-trip the tubing under pressure — this means without killing the well with mud — will figure about $2,800.00, excluding rig costs.

6...12 hour days
or 72 hours as follows:
The first 40 hours...$1600.00
32 hours at 30.00 an hour..960.00
Mileage charges are
80 miles at 75¢ per mile...60.00
Wire line work to plug
tubing and remove plug...170.00
$2,790.00

By way of comparison, our district production superintendent's office estimates it would cost around $4,400.00 to kill the well with mud — exclusive of rig costs. These figures are based upon completing the job without running into trouble, of course.

Oil base mud.....$2200.00
Pump truck to kill well...580.00
Steel mud pits.....100.00
Reserve pits.....100.00
Swabbing.....200.00
Extra mixing and pump
time to handle
oil base mud.....1200.00
$4,380.00

Besides the initial savings we'll make by using Otis Tubing Service, we're eliminating the possibility of fouling up the producing formations with mud. On a few occasions, we killed a well because we thought it would reduce our workover expenses — but by the time we got through cleaning up the formations to bring production back, our costs had skyrocketed. One or two times the well never did come back to full productivity. These proved to be some of the most expensive workover jobs we ever did. We learned the hard way.

When Otis pulls and snubs pipe under pressure they furnish all the special tools, equipment, and trained personnel to do the job. Once they rig up their control heads, snubbers, and lubricator, they set a plug below the packer or in the bottom joint of the tubing and start coming out of the hole with the pipe. Their crews are fast and efficient, and pulling tubing under pressure is no strain the way Otis does it. So, naturally we use Otis Tubing Service all the time. We've found we can save both time and money the Otis way.

If you haven't been using Otis regularly I suggest you contact their nearest office today. Remember—when a workover is in order and pressure presents a problem —

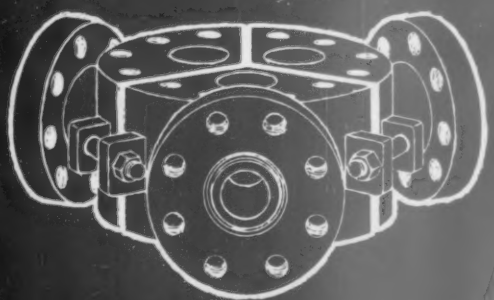
don't kill your well....
Call Otis!®

OTIS ENGINEERING CORPORATION

General Offices: 6812 Denton Drive • Dallas

Branches Throughout the Oil Country

The Ultimate in Flexibility for Triple Completions



TRI FLANGED TEE

THE O·C·T TRI FLANGED TREE

There is *no* doubt about the payout when three good zones can be flowed through one wellhead. There *is* doubt when you use a jumble of complicated equipment.

The O-C-T Crescent Flange Tree is tailored for dual completions. And now we are proud to present the "Tri Flanged Tree" tailored for triple completions.

Like the Crescent, the "Tri Flanged Tree" offers the ultimate in *flexibility*, *simplicity* and *economy*. One valve in this triple hookup can be removed without disturbing the remaining two valves. Or, if necessary, any two valves can be removed without disturbing the third.

If there is a multiple producer on your horizon, talk to the O-C-T representative nearest you. He can solve your equipment problems before the problems arrive.

where progress is a daily practice

O·C·T

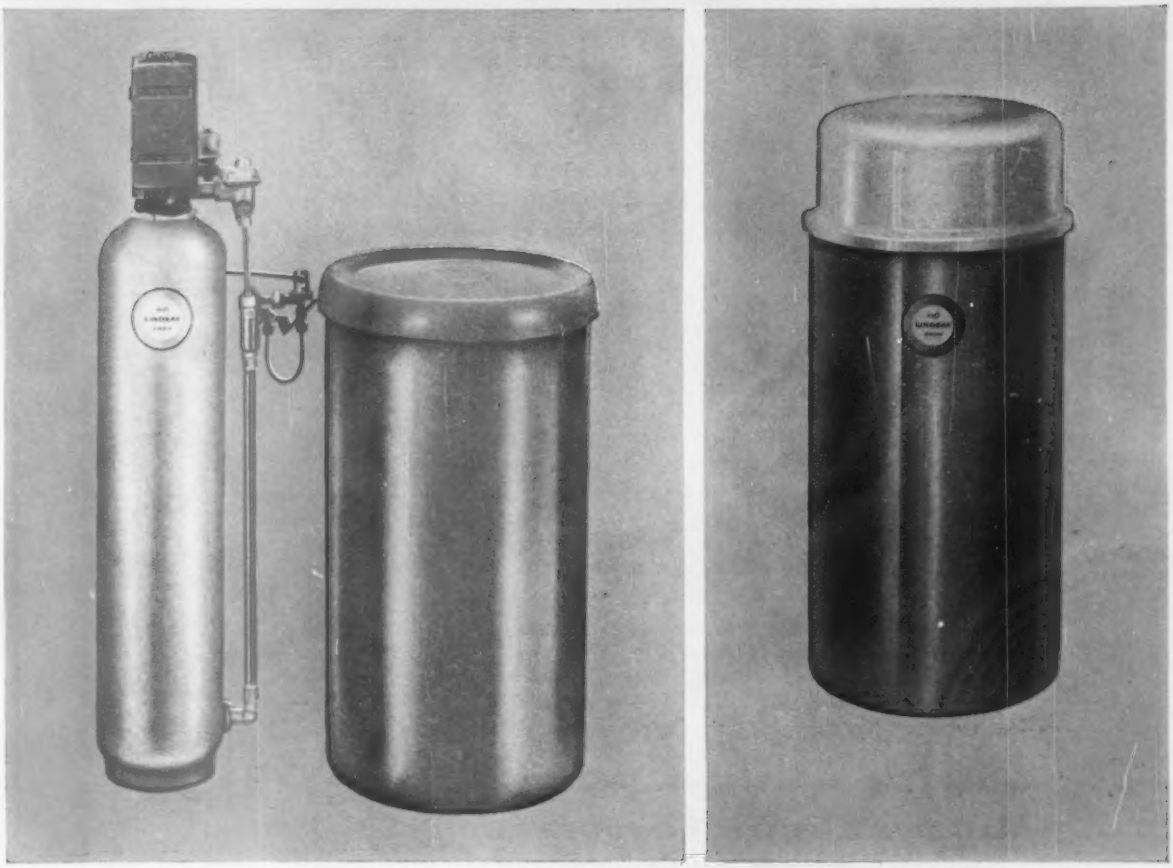
OIL CENTER TOOL CO.

SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

Address Export Inquiries for All Countries to
P. O. Box 3091, Houston, Texas.

Naugatuck KRALASTIC

THE ORIGINAL ABS RESIN



Molded parts by Contour Plastic Molding Co., St. Paul, Minn., and Rayette, Inc., St. Paul, Minn.

KRALASTIC... because it molds clean and easy, and is corrosionproof

The Lindsay Company, St. Paul, Minn., is the largest maker of home automatic water softeners.

Lindsay uses KRALASTIC® for vital strainers and other fittings, both in its "Custom" model (left, above) and its "Urbanite" model (at right). KRALASTIC never contaminates any fluids; it withstands just about all chemicals—and, of course, can easily be made into complex moldings, large or small. *Never rusts.*

For fast information on the many uses and advantages of this tough rubber-resin material, the original ABS plastic, contact us today at the nearest district office indicated or the address below.

United States Rubber

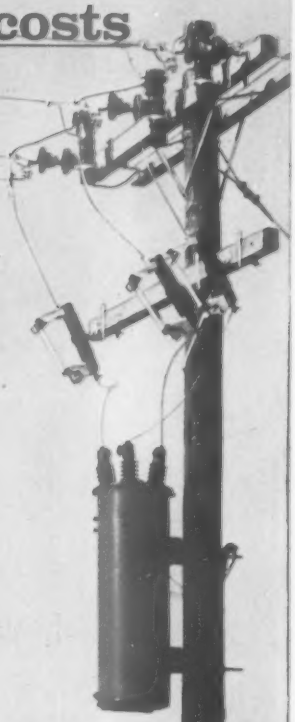
Naugatuck Chemical Division

DEPT. 516K ELM STREET
NAUGATUCK, CONNECTICUT

KRALASTIC RUBBER-RESINS • **MARVINOL** VINYLS • **VIBRIN** POLYESTERS

Akron · Boston · Chicago · Gastonia · Los Angeles · Memphis · New York · Phila. · CANADA: Naugatuck Chemicals · Elmira, Ont. · Cable: Rubexport, N.Y.

We've matched a transformer with a motor to cut your oil well pumping costs



You can reduce the costs of electrified oil well pumping by putting this Wagner motor and transformer oil well pumping "package" to work on your wells.

The light-weight pole-mounted service transformer is matched to its motor load—puts an adequate, dependable power supply close to the load. You can electrify leases by bringing the high voltage line to each oil well installation . . . operate each well individually. You save up to 25 percent in line materials and labor—eliminate many dead ends—reduce system losses by as much as 65 percent.

The Wagner motor is engineered specifically for oil well pumping. It has plenty of torque to handle heavy initial loads without laboring or stalling. Its high slip (carefully determined by field tests) enable it to run smoothly under cyclic loads. Class B insulation protects the motor windings, gives greater thermal capacity to absorb the heat from peak loads. It consumes fewer kilowatthours per barrel because of its efficient operation in its specific job. These motors are built in ratings of 5 hp and larger.

Your nearby Wagner field engineer will be glad to tell you about the Oil Well Pumping Motor and Transformer "Package", help you plan oil well pumping, gathering and water-flooding systems, assist you in solving your electrical problems. Call him today, or write for Bulletin EU-426A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

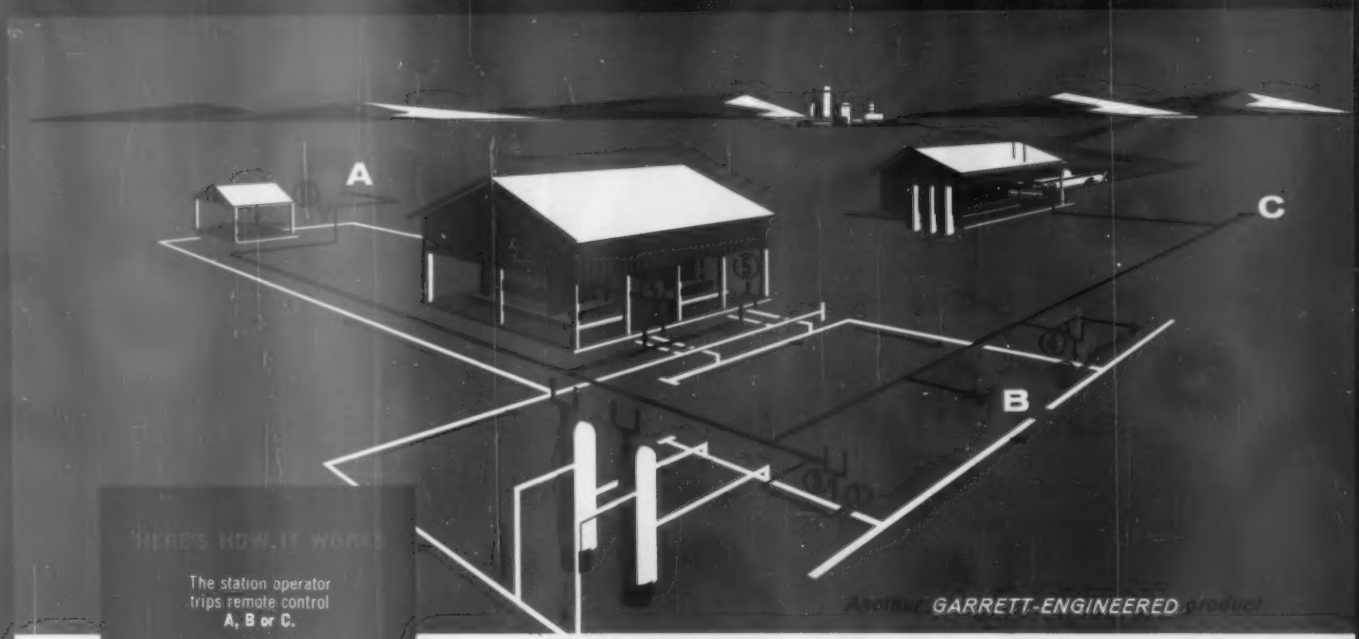
Wagner Electric Corporation

6400 PLYMOUTH AVE., ST. LOUIS 33, MO.

WM60-5

SERVING 2 GREAT GROWTH INDUSTRIES—*ELECTRICAL • AUTOMOTIVE*

New Safety *for compressor stations*



GARRETT-ENGINEERED product

HERE'S HOW IT WORKS

The station operator trips remote control **A, B or C.**

STATION ISOLATED

Suction firegate closes

Discharge fire gate closes

PRESSURE DISCHARGED

Suction relief valve opens

Discharge Relief Valve opens

Compressor unit relief valves open

ENGINE SHUT DOWN

Fuel gas relief valve opens

Tripping a single remote control instantly isolates a compressor station from the main line while simultaneously cutting off engine fuel and blowing down internal lines in Garrett's new safety shut-in system.

The station can be restored to service quickly without purging of lines. Block valves permit continued operation of station during periodic blow down testing of valves without loss of thousands of dollars in gas.

Designed to work with relief valves normally installed at compressor stations and with existing engine starting air pressure . . the Garrett safety shut-in system may be obtained for little more than the cost of adding "type EO" operators to the existing relief valves.

Check with your nearby Garrett representative or write direct for the full story of this NEW safety shut-in system for your compressor stations.

USI Garrett Oil Tools

DIVISION OF U. S. INDUSTRIES, INC.
P. O. BOX 2427, LONGVIEW, TEXAS

Vogt PACKAGED

FORGED STEEL FITTINGS, FLANGES and UNIONS

Complete product identification and data on label attached to carton.

Vogt modular designed cartons give added handling and storage space economies. All dimensions are in multiples of 3 inches.

for

MATERIAL HANDLING ECONOMY

1 Easy Inventory Identification

2 Easy Handling

3 Protection Against Damage

Handling and inventory costs are held to a minimum with Vogt modular packaged forged steel fittings, flanges, and unions. The small cartons, of restricted weight, are appreciated by the distributor and user alike for their easy handling and the protection given the products against damage.

The label attached to each carton completely describes and pictures the product and gives the quantity, size, end type, pressure, and catalog number.

Write for Folder PF-4 for complete data on quantities and weights of the items as packaged in various sizes of cartons.

Address Dept. 24A-FO

HENRY VOGT MACHINE CO.

P.O. Box 1918 Louisville 1, Ky.

SALES OFFICES New York, Chicago, Cleveland, Dallas, Camden, N.J., St. Louis, Charleston, W.Va., Cincinnati

YOU NAME THE MUD SPERSENE THINS IT.....

	Weight—lb./gal.	Viscosity—sec./qt.	Gel Strength—Initial/10 min. lb./100 sq. ft.	Fluid Loss—cc.
Gyp mud	19.0	63	0-3	3.9
Lime mud	12.7	53	0-0	5.0
Saturated salt mud	15.0	64	0-4	2.8
Sea water mud	10.8	40	1-4	7.4

...tells the story. Based on ...ud reports of actual drilling wells, it gives conclusive evidence that Spersene® controls viscosity and gel strengths in different types of drilling fluids. The facts prove that Spersene is highly effective in gyp, lime, and salty muds.

Spersene permits the use of high weight gyp muds for deep drilling. The low alkalinity of gyp-Spersene muds improves stability at high temperatures. And, Spersene is soluble in fresh and **salt** water.

Spersene is one more tool developed by Magcobar Technology. The Magcobar mud engineer knows Spersene, knows how to use it right for highest performance. He can help you plan your drilling program with Spersene for maximum economy.

So, wherever you drill, begin planning with Magcobar. You'll find that Magcobar Technology combines the finest engineering skills with high performance products to avoid costly trouble in drilling to let you drill at the lowest cost per foot every foot of the way.

Well Done With Magcobar Technology

Magcobar
Complete
DRILLING MUD SERVICE

DRESSER INDUSTRIES, INC.
OIL • GAS • CHEMICAL
ELECTRONIC • INDUSTRIAL

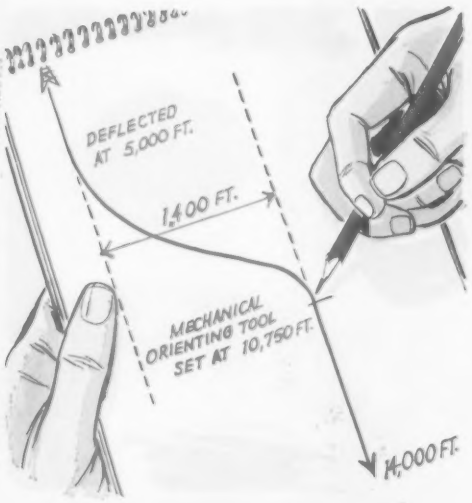
MAGNET COVE BARIUM CORP.
HOUSTON

ANOTHER **HOMCO**
DIRECTIONAL DRILLING
SUCCESS REPORT

Need a Road Map 14,000 Feet Down?

Gulf Coast Operator reports:

"Homco's Slim Hole Survey Instrument was a real time and money saver on this directional job. We dropped this "Go-Devil" type instrument 63 times, from 10,000 to 14,000 feet with good results."



1. On this hole we had to go straight down to 5,000 feet, then offset 1,400 feet and hit our target area at 10,750 feet, then dig a straight hole to 14,000 feet.

NEED THE ANSWER
TO A DIRECTIONAL DRILLING PROBLEM?

HOMCO HAS IT!

HOMCO

DIRECTIONAL DRILLING

HOMCO ALSO OFFERS

2. One of our problems was that we did not have enough wire line to go below 10,000 feet. Another was that on our 2⅞" drill pipe, we were using tools that had only 1½" ID, and the survey instrument had to be dropped through this small opening.

3. We used the Homco Slim Hole Survey Instrument 33 times to successfully reach TD. After reaching TD of 14,000 feet, a fishing job was encountered.

4. We plugged back to 10,500 feet and, using a Homco Mechanical Orienting Tool and a Homco Deflecting Tool, sidetracked the hole.

5. We used the Homco Slim Hole Survey Instrument successfully another 30 times to TD.

HOMCO "HK" SUBSURFACE DIRECTIONAL SURVEY INSTRUMENTS

The HOMCO "HK" Angle Compass Units are the only non-friction apparatus available to obtain course deviations from the vertical and the direction in which this deviation was made. This non-friction property of the "HK" units permits greater accuracy than is possible with any other instruments used in the survey of bore holes today.

The Homco "HK" Singleshot

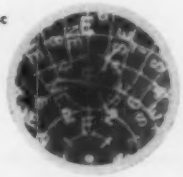
This instrument obtains photographically the information necessary to directionally drill bore holes or to locate bottom, or any part of the bore hole, in relation to the surface. This instrument is applicable to any uncased bore hole over 2¼" in diameter. An inclinometer (only) unit is available for inclination surveys in cased holes.

The HOMCO "HK" instrument may be go-deviled to land in a non-magnetic collar, or to protrude through certain core bits into the open hole. It may also be used on a wire line in the open hole, or to land in a non-magnetic drill collar. It is also frequently used with other tools.

The Homco "HK"-HKS, (slim hole survey instrument)

This instrument is an adaptation of the "HK" SINGLESHOT. The HKS instrument has a protective case that is only 1¼" in diameter and thus can be run in much smaller pipe.

"HKS" Single Shot Disc
(2 times actual size)



The Homco "HK" Go-Devil Multishot

This instrument makes multiple recordings photographically of the information necessary to calculate the deviation of the entire depth of a bore hole. Designed primarily for go-devil operation it may also be lowered on the end of a string of pipe, or lowered into an uncased hole on a wire line.

This instrument uses the same basic principle as the "HK" singleshot. The difference being that the "HK" Multishot makes multiple recordings rather than a single recording on each trip in the hole. A directional survey of the bore hole can be conducted any time it is necessary to remove the drill string from the hole.

HOMCO

HOUSTON, TEXAS (HEADQUARTERS)

ASSOCIATED A OIL FIELD RENTALS

EXPORT OFFICES
New York, N.Y.
Mexico City, Mexico
Long Beach, California
Maracaibo, Venezuela
Paris, France
Geneva, Switzerland

GUIBERSON TYPE F

AUTOMATIC AIR OPERATED TUBING SPIDER

Handle any length tubing string . . fast . . safe . . sure

BIG, TOUGH, RUGGED, Guiberson Type F Spider makes it possible for one man to handle the longest, heaviest tubing string safely with no scoring or crimping of the tubing. Slips have a long, generous contact with the pipe. Slips maintain 3-point contact for automatic alignment, maximum stability, even load distribution.

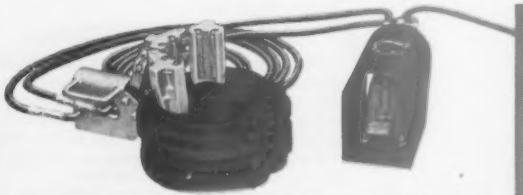
FAST AND SAFE, the Type F Spider speeds-up workover, completion jobs and slim-hole drilling with *hands-free* safety. Slips are released and retracted automatically by a remote control foot pedal, cutting time, eliminating the danger of hand operated slips. Slip inserts are easily and quickly replaced in the field.

SELECTOR ON THE FOOT VALVE provides: (1) single foot-pedal action, depress to retract slips, release to set slips or (2) double foot-pedal action, slips retract when pedal is depressed and released. Pedal must be depressed and released again to return slips to bowl. Both actions can be reversed by reversing hose connections at spider.

TWO OPERATIONAL PRESSURE RANGES are provided, 80-125 psi or 40-80 psi. Changing from one range to the other is a simple operation at the spider.

Save time . . gain extra safety . . with Guiberson Type F Spider . . get complete information from a Guiberson man or see it at your supply store.

Sold by Oil Field Supply Stores Everywhere



GUIBERSON TYPE H AUTOMATIC AIR OPERATED TUBING SPIDER is a short, compact version of the Type F . . designed for medium depth wells up to 9,000′ for 2⅛″ O.D., 8,000′ for 2⅜″ O.D., or 6,000′ for 3½″ O.D. tubing.

SAFE THAN SORRY GUIBERSON BE A BELIEVER

THE GUIBERSON CORPORATION

ESTABLISHED 1919 — DALLAS, TEXAS U. S. A.

Here's how they **keep mud moving** *on "Mister Cap"*

Mounted directly above the mud tank—with its steel shaft reaching down into the mud—is a LIGHTNIN Mixer.

At the bottom of the turning shaft, a big turbine-type impeller drives the mud in a steady, powerful flow. All through the tank, mud keeps mixing, interchanging, equalizing. It doesn't settle out. It's always in condition. And if necessary, mud weight and viscosity can be changed at the drop of a hat.

This is what you'll see aboard "Mister Cap," the 4000-ton all-electric offshore mobile drilling barge that brought in its first producer in just eight days—and has been meeting its owners' expectations ever since as a model of drilling efficiency.

You can get faster, safer, more productive drilling with LIGHTNIN Mixers on *your* rigs. Fewer stops. No long waiting for mud to get into condition. Surer protection against blowouts.

Cut pump maintenance cost, too. When you have LIGHTNIN Mixers you don't have to use your standby pump for jetting mud. It's always instantly available for use on the hole.

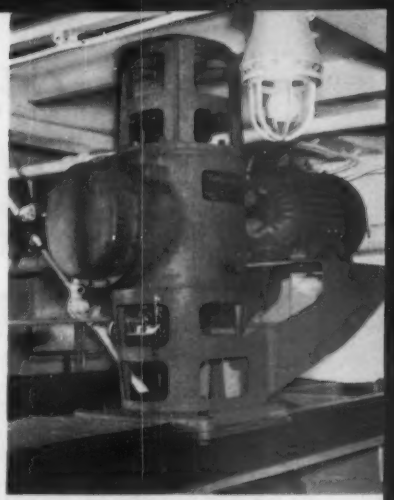
See for yourself why so many offshore and land rigs use this simple, fast way to control mud. Ask your LIGHTNIN Mixer representative to set up a visit to one of these rigs in your area. Call him today (he's listed in Composite Catalog). Or write us direct.

Lightnin® Mixers

MIXCO fluid mixing specialists

MIXING EQUIPMENT Co., Inc., 174-e Mt. Read Blvd., Rochester 3, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 19, Ont.

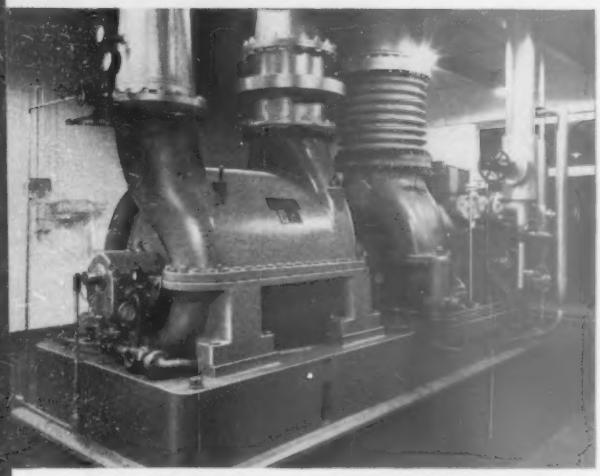


Mud mixers like this one keep all of the mud in suspension, with uniform gravity and viscosity.

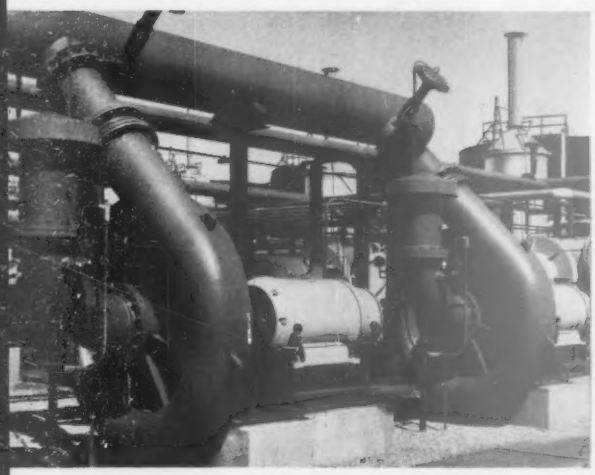
THREE-LEGGED JOB-HOPPER "Mister Cap" spudded and drilled its first producing well in 8 days; has worked steadily in the Gulf since November 1957. Built by R. G. LeTourneau Inc., the barge is owned and operated by Barnwell Offshore, Inc.

in Chemical and Petroleum Refining Service–

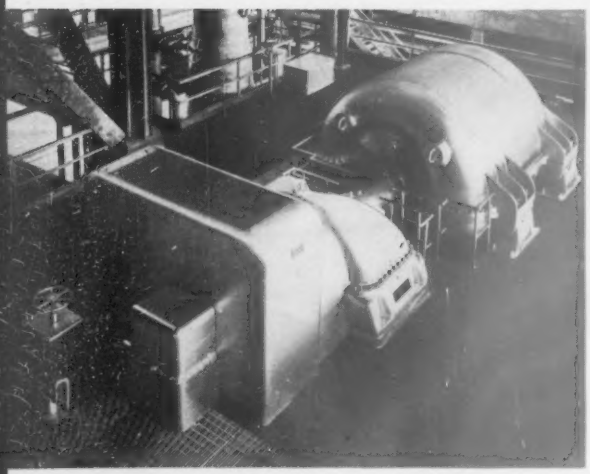
ELLIOTT



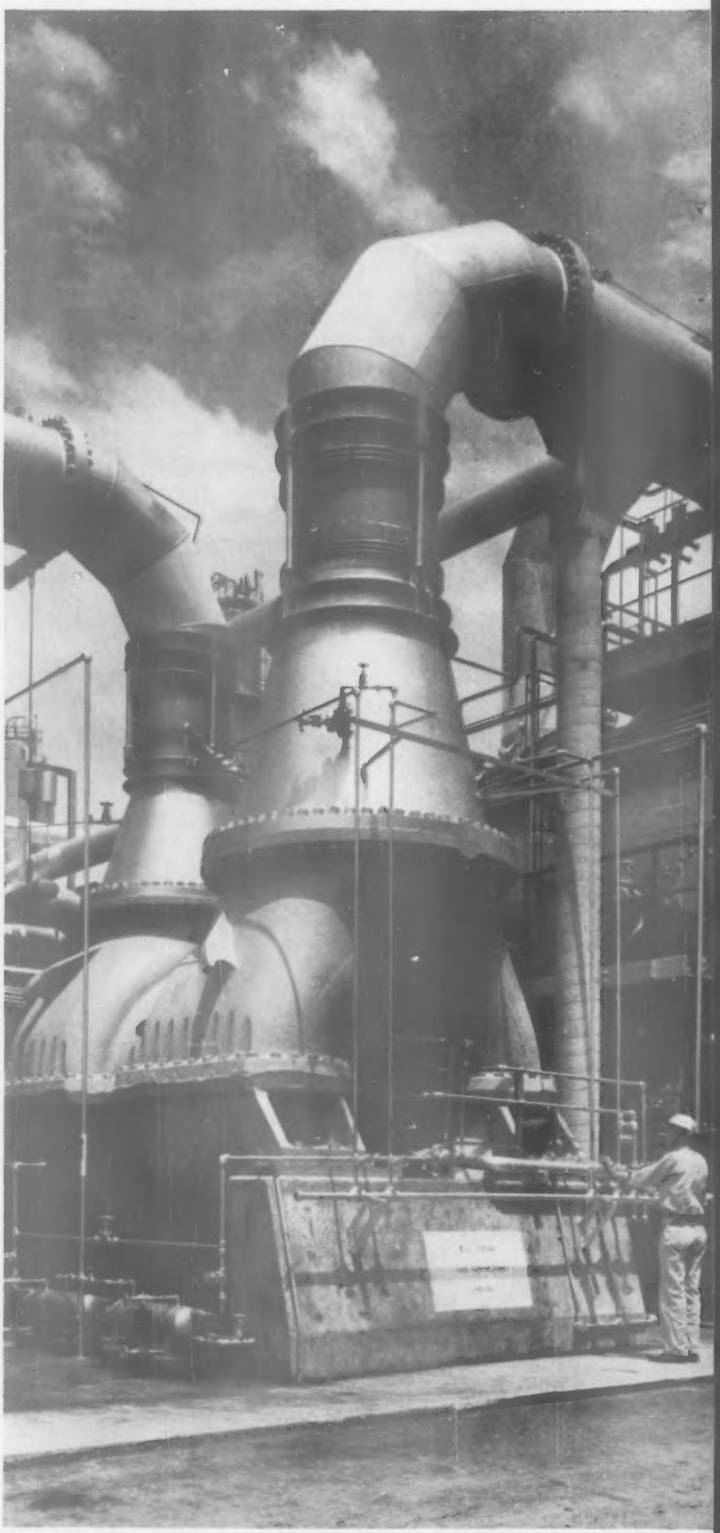
Elliott multi-stage compressor with 2035-hp Elliott turbine drive, in refinery service.



Two single-stage Elliott compressors driven by Elliott motors.



One of the largest turbine-driven multi-stage compressors ever installed, for fluid catalytic cracking unit.



One of the large axials serving a Petro-Chemical plant.

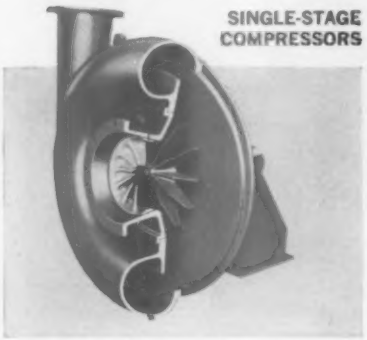
COMPRESSORS

Today's most complete line of centrifugal and axial machines from **500** *cfm to* **600,000** *cfm*

48 FRAME SIZES WITH MATCHING DRIVERS

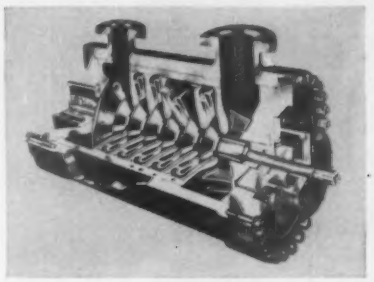
With this, the most-complete line of centrifugal and axial compressors available today—Elliott offers an unexcelled range of choice of established machines. In addition, there is the extra advantage of matching Elliott turbine or motor drivers. Both units engineered and built by Elliott is a decided "plus" because it means unified responsibility, unified service.

SINGLE-STAGE COMPRESSORS



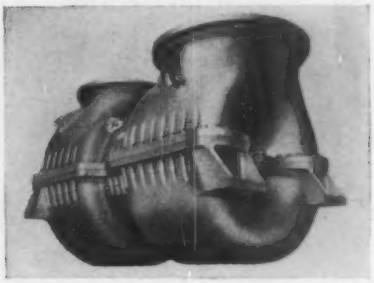
Elliott single-stage centrifugal compressors range in size from 700 to 100,000 icfm and above. They are readily adaptable to special service conditions, and to the handling of corrosive or dirty gases. A variety of impeller designs, bearings, seals, and materials of construction permits each unit to be tailored to its particular application.

MULTI-STAGE CENTRIFUGAL COMPRESSORS



Elliott multi-stage compressors are made in a wide variety of sizes and styles, to serve many difficult and exacting applications. They are available with inlet capacities up to approximately 150,000 icfm. Impellers, casings, internal passages and bearings for each type of machine have been designed to provide smoothly operating, rugged, dependable machines.

AXIAL FLOW COMPRESSORS



Multi-stage compressors of the axial flow type are designed and engineered specifically to serve the needs of industry for the handling of air or gas mixtures in large volume flow operation. Applications include petroleum refining, chemical processing and the steel industry. Frame sizes are rated up to approximately 600,000 cubic feet per minute when operating on air.

MATCHED MOTOR OR TURBINE DRIVE

Elliott is a leading manufacturer of both steam turbines and electric motors, of all types and ratings necessary to provide driving power for the compressor units described above. Consequently, we are in position to recommend and furnish the type of drive best suited for each application.

FOR AIR OR GASES

Elliott integrated compressor units are available for handling all types of compressible fluids, within the pressure and flow limits of the machines. Where corrosive gases are handled, special materials are employed in vulnerable spots; where high pressures are needed, extra heavy construction is used; where leakage must be prevented, special shaft seals are available; where high temperatures must be avoided, provision is made for cooling.

48 STANDARD FRAME SIZES

The total of 48 frame sizes permits accurate application for all compressor problems over the entire range of 500 cfm to 600,000 cfm. Pressures and speeds can be selected to meet the characteristics of the application, and the gas to be handled. *For further information, write Compressor Department, Jeannette, Penna.*

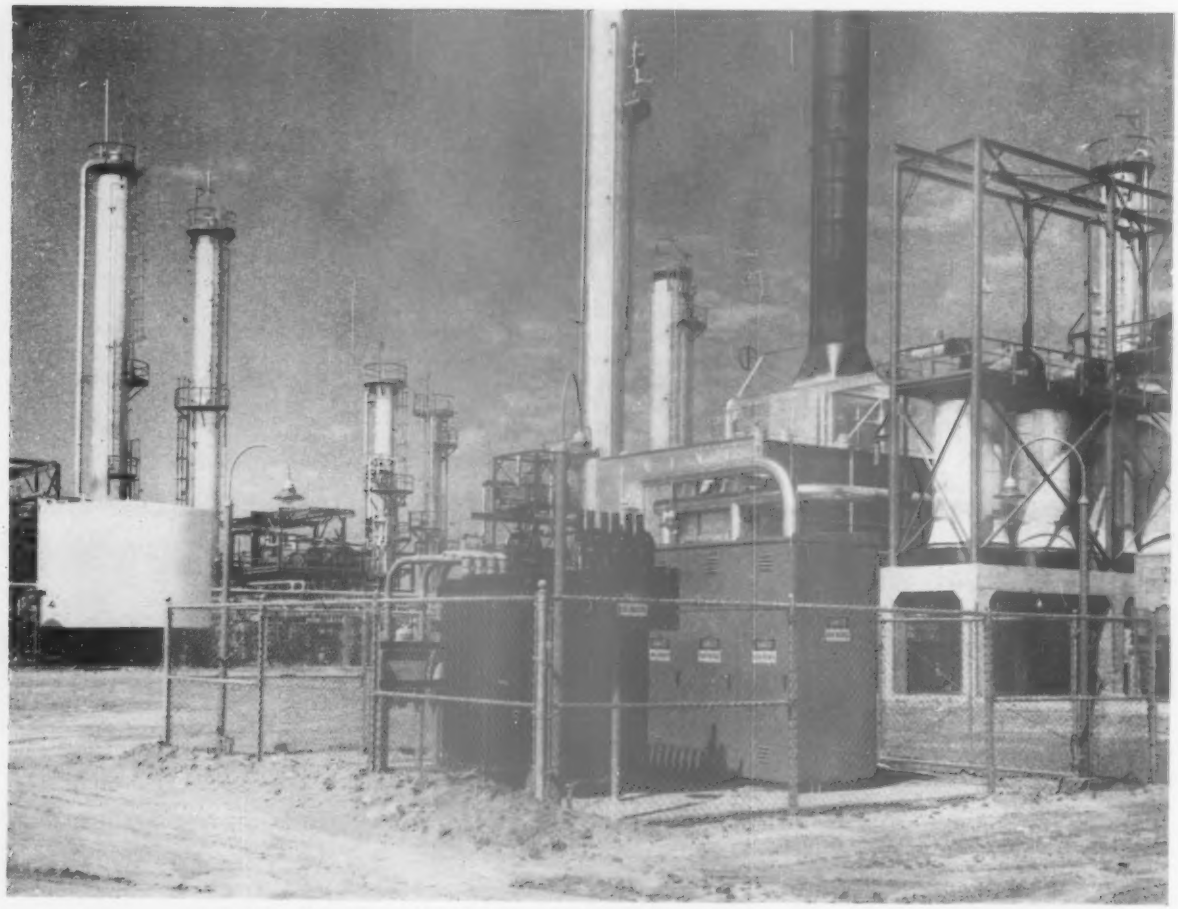
ELLIOTT THE MOST COMPLETE LINE OF **INTEGRATED COMPRESSOR & DRIVER UNITS** 500 cfm to 600,000 cfm

ELLIOTT Company
Jeannette, Penna.

PO-1

You can depend on purchased electric power for

LOW MAINTENANCE



Substation for purchased electric power supplying a large southern refinery.

For energy that reduces operating costs, many refineries rely on purchased electric power.

The refinery shown here is only one of hundreds of installations throughout the country where utility electric power is at work around the clock . . . with a record of high continuity of service and low upkeep.

Whether your operation involves refineries, pipelines, gathering, flooding or pumping check with your nearest Utility Electric Power Company for assistance in economical electrification.

Purchased Electric Power . . .
saves money, manpower, maintenance, and serves you better automatically

Petroleum Electric Power Association

P. O. BOX 35006, DALLAS 35, TEXAS

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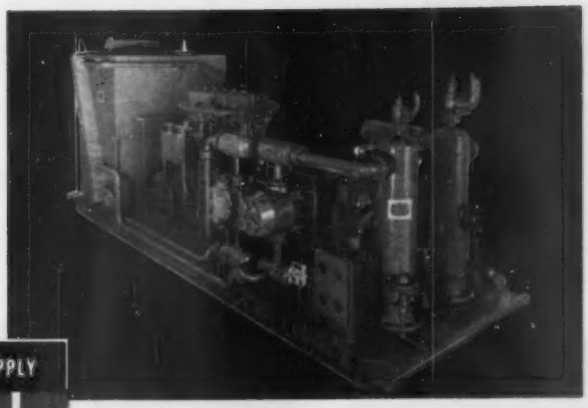
INGERSOLL-RAND



HHE PACKAGED

COMPRESSORS

Favorite in the Field

The **new** Wilson Supply-Ingersoll-Rand HHE packaged compressor is already a favorite with many operators. Installation costs are less because the unit's opposed cylinder design practically eliminates vibration. Operators have found the HHE a flexible unit, too. It can handle a wider range of field applications with its low and high stage "controller clearance" liner-type cylinders.

The HHE unit is becoming the favorite in the field, and currently units are handling a variety of field applications in Oklahoma, Kansas, New Mexico and Texas.

For complete information on the Wilson Supply-Ingersoll-Rand HHE packaged compressor, contact your nearest Wilson Supply store or write: Compressor Division, Wilson Supply Co., P. O. Drawer 19, Houston. Please give suction, discharge and volume to be handled.

"WHAT YOU WANT — WHEN YOU WANT IT"

WILSON SUPPLY CO

HOUSTON, TEXAS

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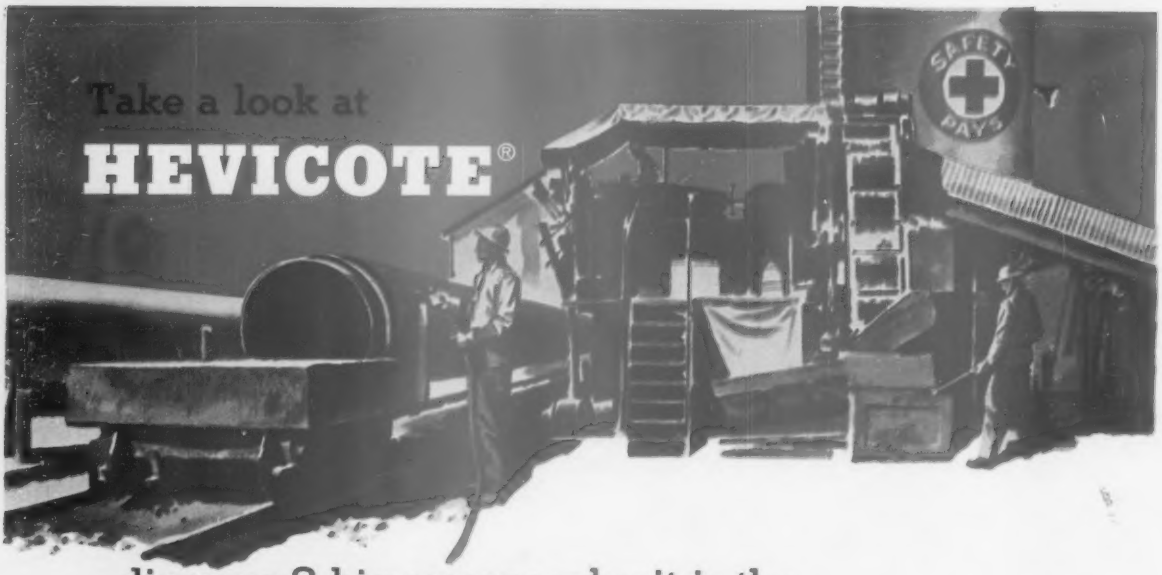

discover 3 big reasons why it is the PREFERRED Concrete Pipe Coating!

Years ago, the H. C. Price Co. Pipe Coating Division pioneered the first concrete pipe coating. Since then, constant improvements have been made in the Price Co. manufacturing and application processes, and in the coating material itself. Here are three of the many reasons for choosing HEVICOTE® pipe coating when weight is needed on your line.

Accurate Weight Control—Through the pre-tested use of aggregates of varying weights, HEVICOTE® pipe coating delivers the displaced weight required by the customer's specifications. In addition, each joint of HEVICOTE®-coated pipe is measured for length and circumference, weighed, and marked at each plant to guarantee the required specific gravity and to facilitate on-the-job placement.

New Extrusion Process—Now, exclusively from H. C. Price Co., an extruded HEVICOTE® that gives a smoother, more uniform surface, which facilitates field molding, handling, and laying.

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Get the facts about HEVICOTE®, and the combination of this superior concrete coating with SOMASTIC® or any chosen anti-corrosive coating. Because of its greater weight, SOMASTIC® reduces the quantity of weight material required and in some cases can eliminate entirely the need of additional weight. Call the Pipe Coating Division Plant nearest you for free consultation.

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Price Tower, Suite 152 • Bartlesville, Oklahoma

☐ Send me information on HEVICOTE® concrete coating, including weight and displacement tables.

☐ Send me current information including scientific papers, about the corrosive protection and weight advantages offered by SOMASTIC® pipe coatings.

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HEVICOTE® brochure, with weight and displacement tables, and results of scientific examination of SOMASTIC®-coated pipe, plus a newly issued booklet on SOMASTIC® uses and specifications are now available. Return the coupon for this free material.

LET D+B MEN KEEP YOUR PROBLEM WELLS PUMPING..*Economically*

You name the problem.. D+B Specialists will solve it

Deeper production, waterflooding and many more changing conditions present new and more serious pumping problems that require solving by engineering analysis and knowledge. It's here that D+B Production Specialists .. fully trained and field seasoned .. provide up-to-date information on regional conditions, new pump designs and applications, and special alloys. They are trained to join forces with your field superintendents and engineers in keeping your production costs down.

From the wide range of D+B Subsurface Pump designs .. 37 types with over 700 variations .. it is possible to solve all pumping problems. D+B Pumps are designed primarily with standard API parts .. completely interchangeable. Special, more costly parts are used only where needed to beef-up critical components exposed to heat, gas, abrasion, corrosion and other wear factors. You get a better engineered, more efficient pump without costly over-designing.

78 strategically located D+B Pump Shops serve the U.S.A., Canada and South America

Working closely with D+B Production Specialists are the foremen of D+B subsurface pump shops. They offer you an extra certainty of quality service, thanks to factory training, natural mechanical aptitudes and intimate knowledge of wells on or near your lease. These are typical of the advantages you gain from Continental-Emsco, an integrated supply company that is fully staffed to supply and service your equipment .. anticipate your needs .. anywhere in the world.

Parts interchangeability.. another way engineering cuts costs

D+B parts interchangeability results in additional savings for operators. As wells deplete, parts from original pumps can be used in other style pumps in other fields. Interchangeability of parts also makes it possible to tailor the pump to meet changing well conditions.

Enlarge your
field engineering force
..at no extra cost..

BY USING CONTINENTAL-EMSCO'S D+B SPECIALISTS

JEP 020
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THESE SPECIAL D+B PUMPS SOLVE SPECIAL PROBLEMS

Sand chewing up pumps? D+B 3-Tube Pumps are designed especially for heavy, sandy production or after sand fracturing. Special pump parts are available for all D+B pumps for longer life in abrasive fluids.

Baffled by gas lock? A *two-pump* principle is used to design D+B Two-Stage Pumps. Well fluid is raised in two stages from a high to a low-pressure barrel. Thus, high fluid pressure on the traveling valve is reduced and gas lock prevented.

Need tubing pump volume with rod pump economy? D+B Duplex Rod Pumps achieve unbelievable volume increases . . from 56% to 66% over conventional-type rod pumps . . 12% to 37% over tubing pumps.

Pumping under severe conditions? Sand, gyp and paraffin build-ups are no problem with D+B Heavy-Duty Stroke Thru Pumps. Self-cleaning *stroke thru* design reduces plunger scoring and sticking.

Looking for low-cost pumps? The economy of D+B One-Piece Liner Pumps fits them perfectly for shallow, non-problem wells. Yet many operators today are getting good service on deep, hard-pumping wells by assembling these pumps with special abrasion-resistant parts. They are available in rod or tubing types for a wide variety of applications. D+B Nu-Simplex Pumps, with cup-type plungers, provide high efficiency with low initial cost in wells to 6,000′, pumping a high percentage of water.

Costing too much to pump from multiple zones? The operational flexibility of D+B Two-Zone Pumps will provide real economy. Basic equipment can be used to pump, flow or plug zones either independently or simultaneously. No need to disturb tubing for zone tests or certain types of completion or remedial work. To meet changing well conditions, a different pump can be installed without pulling the tubing. D+B pumps are retrievable on the sucker rod string for added economy.

Simple design with fewer special parts will cut repair cost . . add salvage value to parts from old pumps. Closer spacing between standing and traveling valves, plus the use of a true standing valve, add up to greater efficiency from your investment.

Ask for bulletins on these pumps at your Continental-Emsco store . . D+B pump shop . . from your D+B representative . . or write direct.

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Here's how one operator

SAVED 5 DAYS RIG TIME

with new Johnston tool!

"The Johnston Selective Zone Tester saved us five days rig time!"

Mr. Ernie Walker, Drilling Superintendent, Calvert Drilling Co.

The Jordon #1 was drilled by Calvert Drilling Company in Dewey County, Oklahoma and bottomed at 11,000 feet.

Drilling the well accomplished only part of the job. Now it became necessary to evaluate all possible producing zones and complete this well if it proved commercially productive. Just as during drilling operations, any delay in evaluation is costly. An idle rig, inoperative tools, equipment breakdown, needless action—all mean lost dollars.

The job of determining subsurface formation conditions was given Johnston Testers. **A total of nine Selective Zone Tests were run:**

Test interval—9534 to 9550 feet. Dual packers top and bottom. Used Johnston Selective Zone Anchor. Good test! Released tool, picked up 8 feet to interval 9526 to 9542 feet. Re-set tool. Another good test!

Test interval—9564 to 9685 feet. Dual packers top and bottom. Used Johnston Selective Zone Anchor. Formation failed to support mud weight. **Picked up tool and re-set seven times at different intervals.** Anchor worked perfectly, did not slide at any time!

The ability to set, release and re-set the Selective Zone Anchor allowed testing of many zones with just one trip in the hole. Extra time was saved since long tailpipe did not have to be run.

Selective Zone Testing with the new "CO" Combination Shut-In Hydraulic Tester and the new Selective Zone Anchor can save you money, too! Call Johnston Testers and learn why you get more from a Johnston Test!

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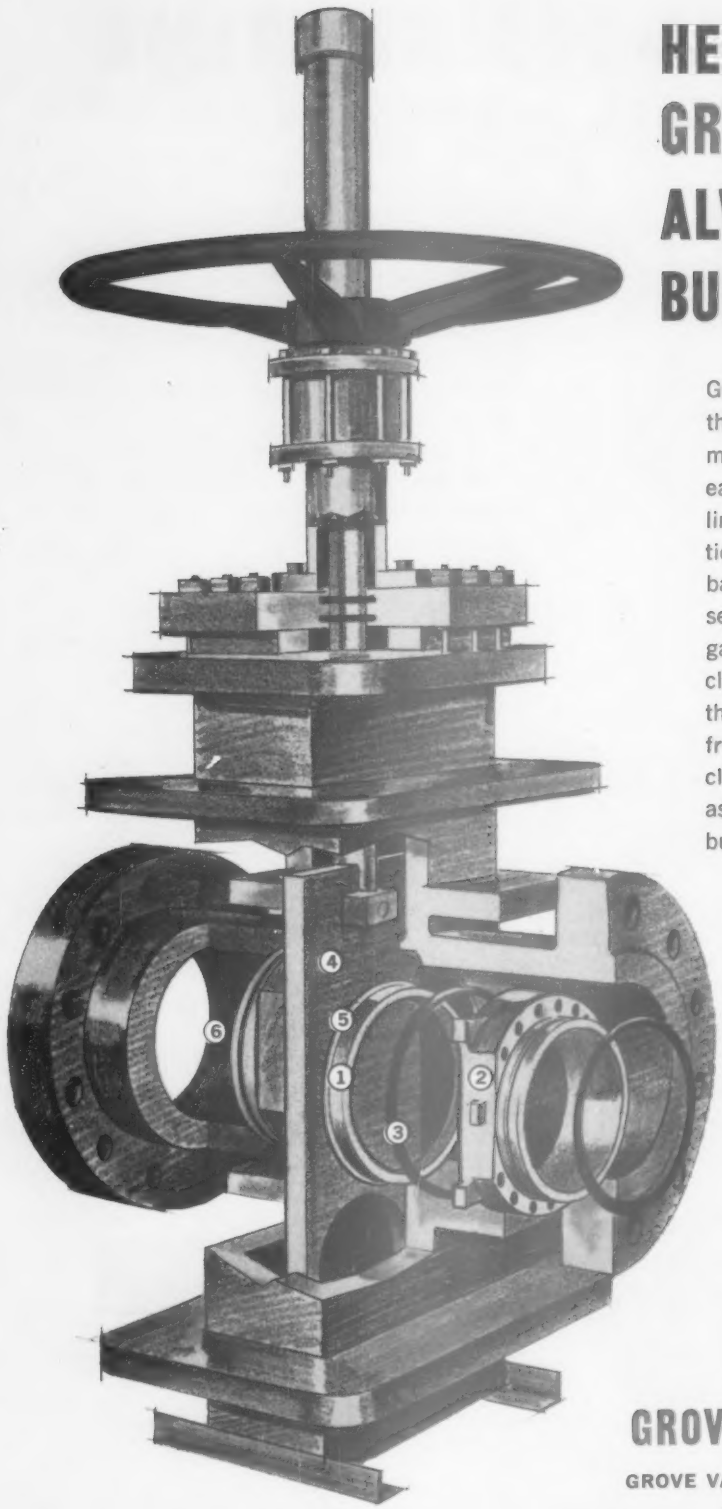

HERE'S WHY A GROVE G-4 VALVE ALWAYS GIVES A BUBBLE-TIGHT SEAL

Grove protected Seal-"O"-Ring® system is the heart of the G-4. Inner (1) and outer (2) metal seat rings shield the o-rings (3) on each side of the gate (4) from damage by line contaminates. Inner seat rings also function as a primary metal-to-metal seal (5) backed up by the o-rings. No lubricants or sealing compounds are needed. The floating gate and seats assure fast, easy opening and closing, and positive, bubble-tight sealing; the inner metal rings scrape foreign matter from the gate while the o-rings squeegee it clean. Through conduit (6) is provided to assure ideal flow characteristics. Send for bulletin #571.

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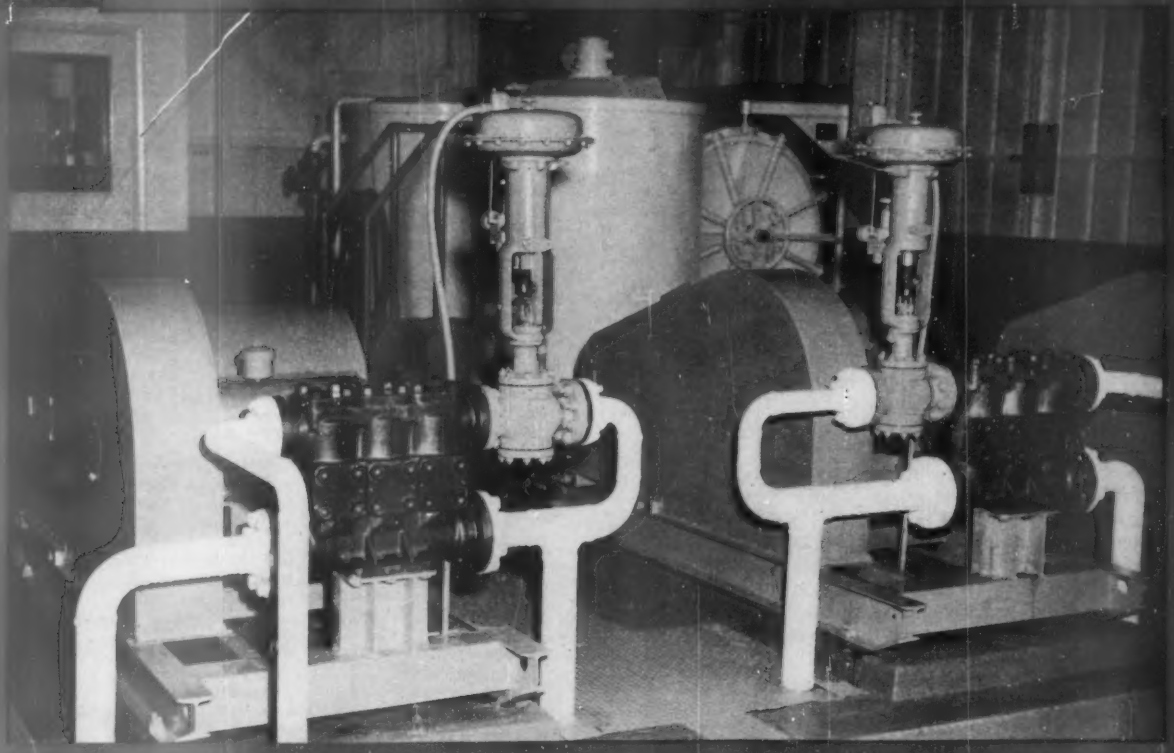
WORLD WIDE PREFERENCE

GASO PUMPS

WHAT'S BACK OF GASO LEADERSHIP IN WATER FLOODING?



There's a Single-Word Answer: PERFORMANCE

The photograph shows one of a steadily mounting number of Gaso installations in water flooding service.

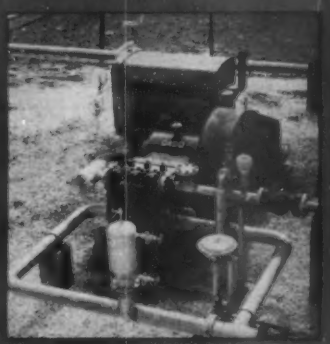
The injection pumps (3) are Fig. 3365, 1¾" x 3" Gaso Horizontal Triplex Plunger Pumps, driven by 40 HP 1200 RPM electric motors.

The fluid ends are of aluminum bronze fitted with ceramic plungers, non-adjustable type plunger packing (in both power and fluid ends) and Bakelite insert type valves mounted on Monel valve seats.

Each of the three pumps, operating at 350 RPM, delivers approximately 1075 barrels a day at 1500 pounds discharge pressure.

Complete adaptability to the job plus GASO design throughout is a time-tested guarantee of thoroughly dependable service extending far beyond the normal life expectancy of pumping equipment.

In the GASO line you will find the effective answer to any pumping problem associated with water flooding. Write for our 1960-61 catalog, or get in touch with our nearest distributor.



Gaso Pump in salt water disposal service in Louisiana

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They Say—

Apologies to Mid-Continent

Dear Sir:

We feel that the coverage of the Slats Honeymon electric rig (OGJ, April 18, p. 112) was quite good. But we think it strange that Mid-Continent's name was so completely absent.

Not only did Mid-Continent play a big role in the development of this rig, but the photographs which you used were taken by Mid-Continent photographers, and the lower flow diagram was drawn by Mid-Continent engineers.

Since this is the newest and one of the first electric rigs for medium depth drilling, we are quite proud of our part in its design and pioneering. Designed around a U-36-A draw works, Mid-Continent engineers were largely responsible for the idea and development of this rig. We don't think it would have been too much to at least mention the make of the draw works under "Individual pieces."

William I. Herod
Advertising Manager
Mid-Continent Supply Co.

(Editor's note: The original manuscript of this article carried a reference to Mid-Continent. The deletion was erroneously made as the manuscript was being prepared for typesetting. We are well aware of the development of the U-36-A by Mid-Continent and we are grateful for the illustrations provided by Mid-Continent for the article.)

Nc Lacq slowdown, he says

Dear Sir:

In the March 7 issue of The Oil and Gas Journal, page 79 ("Lacq Plans Revised") we noticed the following information:

"The Government owned company (Gaz de France) says that increased needs by customers near the field and a high production rate in proportion to reserves forced it to pull in its horns. Another factor is a lack of a market for sulfur stripped from the gas."

This looks like a fancy interpretation of the fact. First of all, I doubt that Gaz de France could make such a statement about one activity which is out of their field.

We, Ste. Nationale des Petroles d'Aquitaine, as producers of natural gas, wish to make it clear that:

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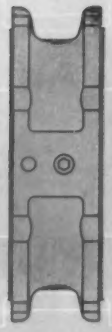
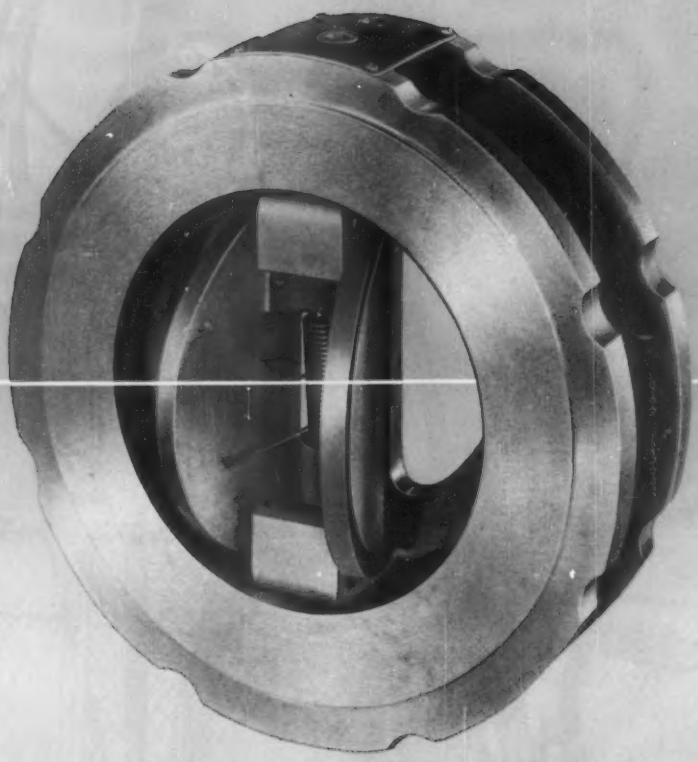
fits between the flanges



less space—weighs only 10% as much



Mission Duo-Chek valves

Mission Duo-Chek Valves weigh approximately 10 per cent as much as conventional check valves. Smaller, lighter Duo-Chek Valves mean that you save on space, weight, installation, and price. But, you are getting a check valve with a bubble-tight seal, anti-slam closure, long life built in. No load is carried on the plate hinges. No external parts. No lubrication required.

The sine wave seal prevents seepage, yet holds without leaking or distortion at maximum test pressure. The sealing material is molded and bonded into a metal groove, making an "O"-ring type seal. Pressure deforms the packing. Metal-to-metal contact completely encloses the sealing material, preventing pinching off under pressure. Available in steel, 316 stainless, aluminum, and bronze to fit ASA raised face or ring joint flanges.

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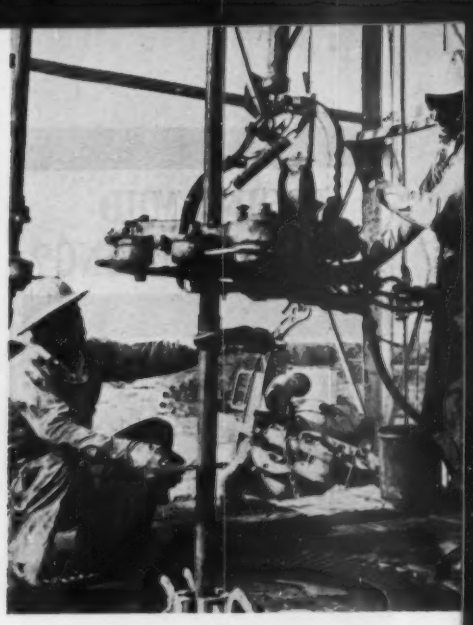
In production equipment, quality is the only key to extra service, reduced final costs....

Quality Equipment Cuts Costs

Cabot Catalog 60 gives you complete specifications on the new Equalign and the Equalastic Adjustable Crank Balanced Series and the Beam Balanced Series. Each Cabot Series has advantages worth your study and consideration; advantages based on minimum maintenance and dependable performance. Call your J&L Supply man for complete information.



J&L Tubing (upper right) plus Axelson Bottom Hole Pumps and Sucker Rods point the way to production economy. The extra service and reduced maintenance of quality equipment assure lower real costs.

J&L offers a complete line of casing and tubing, including special designs for problem production.

Fast dependable service is available from J&L pump shops to back up your investment in quality.

Our Shreveport district office and store (below) is one of many well stocked locations ready to serve you. For quality equipment to cut your real costs ... see your local J&L man ... and save.

Jones & Laughlin

SUPPLY DIVISION – Tulsa

If it's sold by J&L ....
It's the best available

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LOSING MUD DURING DRILLING?

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During drilling operations Jelflake® has proved effective in preventing mud losses to highly-permeable formations. Jelflake is fragmented plastic foil. The crinkled particles are scientifically graded to plug and plaster—to seal off thief zones. Operators find Jelflake effective in cementing operations too. Try Jelflake. Available in strong, wetproof bags at major mud distributors and Dowell stations.

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DIVISION OF THE DOW CHEMICAL COMPANY

DIAL DOWELL

1. The figures of the expendable reserve have never changed from the beginning and are still 200 billions of cubic meters.

2. The rate of production planned for 1961 is still the same: 13 millions of cubic meters per day. We are now up to 50% of that figure.

3. The sulfur stripped from the gas is being sold on the European market without any difficulty, as soon as it comes out of the plant.

We would appreciate very much if you could let your readers know our point of view in one of your next issues.

R. de Beaudean
Delegue aux Relations Exterieures
Ste. Nationale des Petroles
d'Aquitaine
Paris

A job worth doing

Dear Sir:

All of us who have taken part in our political workshops can't help but feel that the job is worth doing and that accomplishments are being made. Certainly your fine article on workshops (OGJ, May 2, "Conoco's Political Workshops Pay Off," p. 82) will help us immeasurably. We are deeply appreciative.

W. O. Ham, Jr.
Southwestern Regional
General Manager
Continental Oil Co.

Articles rate adjectives

Dear Sir:

Your articles on the Beaver-Harper area are instructive and very valuable. They are especially appreciated by those of us who are interested in these two fields.

I hope that you maintain your attention on these two valuable developments. It is very helpful.

Grover O'Neill
New York

Lesser of two evils

"Frankly, I favor compulsory pooling in Texas only because it is the lesser of two evils. It would, of course, be far better to have nothing compulsory. This would be possible, too, under a fair and just interpretation of the laws.

"If the Railroad Commission set a spacing pattern for a field based on sound engineering principles and at the same time adopted a fair allocation formula based on such data, there

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Hooking a Sauder Type T Pressure Treater into your line gives you: 1, an Oil and Gas Separator. 2, a Free-Water Knockout. 3, a Preheater. 4, a Pressure Emulsion Treater — ALL IN ONE!
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type T treater

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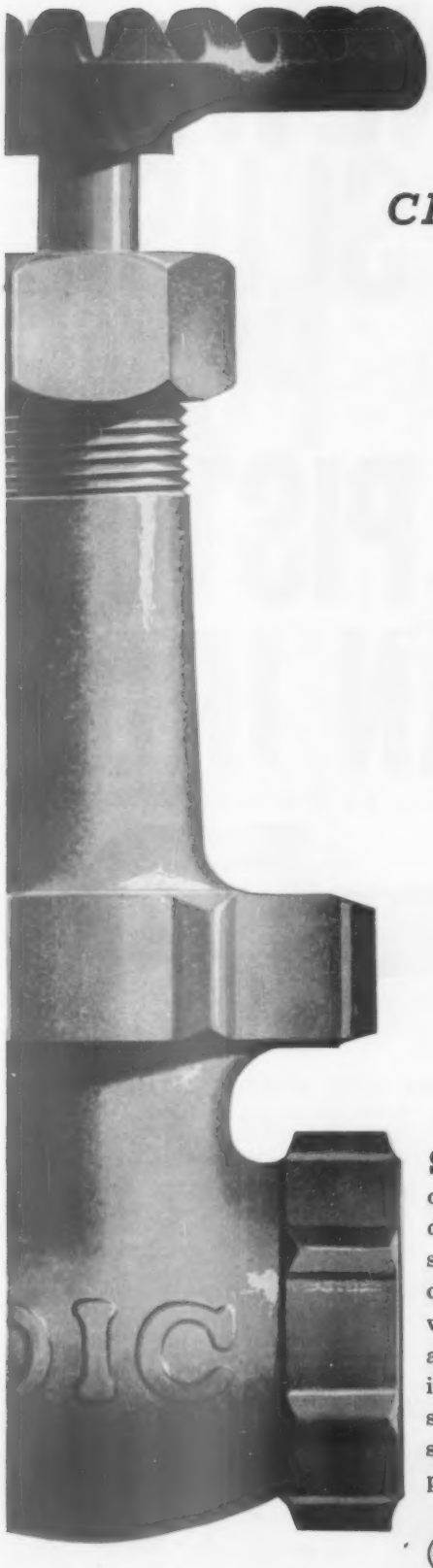
Joins staff of Royal Bank

R. D. Jensen

R. D. Jensen has joined the staff of The Royal Bank of Canada's Oil and Gas Department at Calgary, Alberta. Mr. Jensen has been associated with the oil industry since 1953 and is a graduate Petroleum Engineer of the University of Oklahoma.



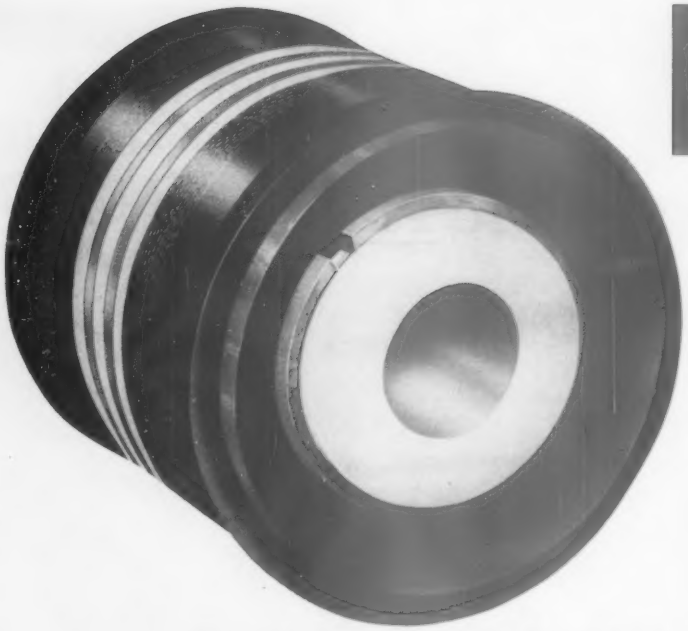
CHECK OIC FIRST...IT PAYS!

SERVICE to meet your valve needs is the "specialty of the house" at your nearby OIC Valve Distributor. As a first-line distributor, he gets OIC's all-out support to insure that you get the service you deserve. OIC's strategically located warehouses, and complete-line factory inventory "backstop" every OIC distributor with a multi-million dollar stock of bronze, iron, ductile iron, cast and forged steel valves. As a result of this strong distributor support, immediate delivery of the more popular items out of distributor's stock is common, and 4 to 5-day delivery out of warehouse or factory stock is routine. When quality is a problem, or delivery is urgent, phone your OIC distributor. Service is his business, and ours.

OIC VALVES

FORGED AND CAST STEEL, BRONZE, IRON AND DUCTILE IRON VALVES

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO



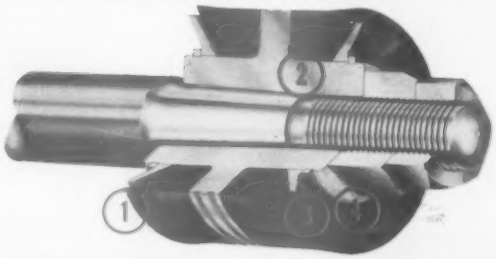
NEW... SLUSH PUMP PISTON by AMERICAN IRON

Engineered for longer life . . . better performance!

Here is the NEW American Iron Slush Pump Piston that is designed to give more performance for the money and more hours of trouble-free service.

This quality piston was developed through research, engineering, experimentation and exhaustive field testing. Every component is precision manufactured from the highest quality material available.

Let the trouble-free service of the NEW American Iron Slush Pump Pistons reduce down time on your rig.



CHECK THESE EXCLUSIVE ADVANTAGES:

1. Synthetic rubber compound, highly resistant to heat, oil and abrasives. Natural rubber also available.
2. Rubber compound is moulded in the I.D. of reinforcing section to stop entry of drilling fluids into fabric.
3. Flexible end plate lengthens life of piston rubber.
4. Design of end plate, snap ring and groove in body assures proper positioning of end plate, plus easy assembly at rig.

AMERICAN IRON

Another AMF Product
PETROLEUM EQUIPMENT

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Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

AMERICAN IRON & MACHINE WORKS CO., INC. • OKLAHOMA CITY •

would be no necessity for compulsory pooling.

"Therefore, if compulsory pooling or compulsory unitization ever comes to this state, we can blame two things. First will be the so-called 'little man' who insists on drilling wells on small tracts regardless of how much he takes from his neighbors, and second will be the arbitrary interpretation of sound laws which ignores the best conservation practices and thereby permits the so-called 'little man' to engage in this plunder."

Michel T. Halbouty, Houston independent, in a speech to the Rio Grande chapter of American Petroleum Institute.

Louisiana first offshore?

Dear Sir:

We are trying to find information as to the location of the first marine drilling, involving drilling for oil or gas over water on a platform, done in the United States.

We have reason to believe that it took place here in Caddo Parish, Louisiana, on Caddo Lake.

Any information that you may have on this subject would be greatly appreciated.

D. W. Chumley, Jr.
Oil City Civic Club
Oil City, La.

(Editor's note: As far as we know, first marine drilling was done in Caddo Parish. Other early offshore drilling also was done in Louisiana. First floating-type barges were used by Texaco Inc. at Garden Island Bay, Plaquemines Parish, and by Jefferson Lake Sulphur Co. at Jefferson Lake in Iberia Parish. First submersible barge was used by Texaco at Lake Barre, Terrebonne Parish, in 1928.)

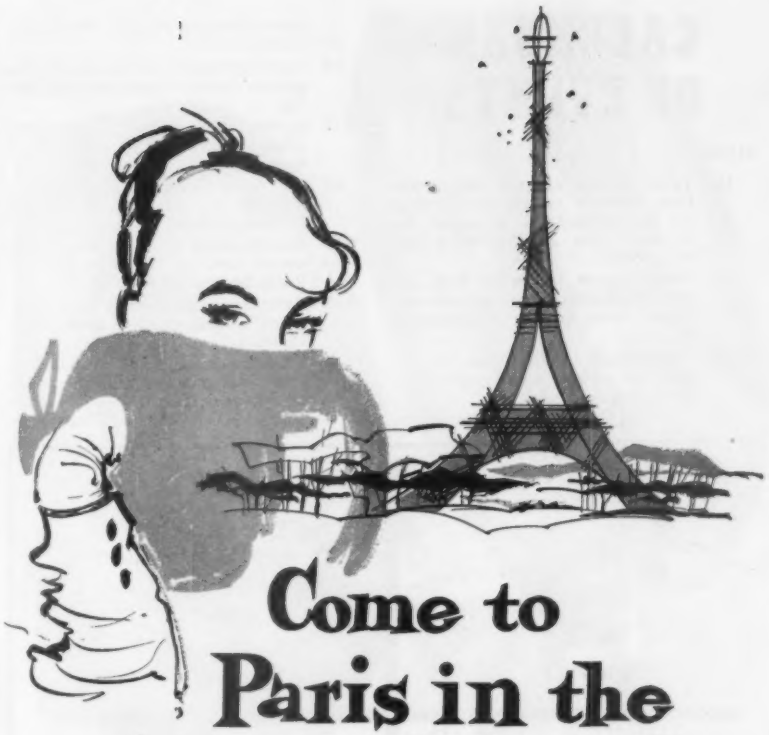
Good things expected

"Despite the many millions of dollars spent developing natural-gas reserves (in Canada), gas has provided only 4% of the $2.5 billion petroleum industry income over the past dozen years.

"Not only will gas export ameliorate the trade situation somewhat, but the ancillary construction projects will help increase employment and contribute additional buoyancy to the economy."

E. D. Loughney, president, British American Oil Co., Ltd., in a speech to the Petroleum Accountants' Society of Oklahoma.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.



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CALENDAR OF EVENTS

JUNE

1-3 Texas College of Arts and Industries, fifteenth annual short course on gas technology, sponsored by Southern Gas Association, Kingsville, Tex.

1-3 West Virginia University, fifth annual Appalachian underground corrosion short course, Morgantown, W. Va.

2 Pennsylvania Grade Crude Oil Association, annual meeting, Pennhills Club, Bradford, Pa.

2-3 Kentucky Oil and Gas Association, annual meeting, Phoenix Hotel, Lexington.

5-9 American Society of Mechanical Engineers, summer annual meeting, Dallas.

5-10 Society of Automotive Engineers, summer meeting, Edgewater Beach Hotel, Chicago.

6-7 Petroleum Electric Power Association, annual conference, Hotel King Edward, Jackson, Miss.

9-11 Manufacturing Chemists' Association, annual meeting, The Greenbrier, White Sulphur Springs, W. Va.

13-15 American Association of Cost Engineers, annual meeting, Rice Hotel, Houston.

13-15 Chemical Institute of Canada, annual conference and exhibition, Chateau Laurier, Ottawa.

13-15 Interstate Oil Compact Commission, midyear meeting, Statler Hilton Hotel, Detroit.

15-16 Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Hotel Lassen, Wichita.

16-18 International Oil Scouts Association, annual meeting, Biltmore Hotel, Los Angeles.

19-22 American Institute of Chemical Engineers, Instituto Mexicano de Ingenieros Quimicos, joint meeting, Hotel Del Prado, Mexico City.

22-25 Canadian Gas Association, annual meeting, Manoir Richelieu, Murray Bay, Quebec.

22-25 American Association of Petroleum Landmen, national convention, Ambassador Hotel, Los Angeles.

22-July 1 University of Michigan, engineering summer conference, topics in multiphase flow, Ann Arbor, Mich.

25-29 Petroleum Equipment Suppliers Association, annual meeting, Banff Springs Hotel, Banff, Alta.

25-July 5 First International Congress for Automatic Control, Moscow, U.S.S.R.

26-28 North American Gasoline Tax Conference, annual meeting, southern region, Eden Roc Hotel, Miami Beach.

26-July 1 American Society for Testing Materials, annual meeting and exhibit, Chalfonte-Haddon Hall, Atlantic City, N. J.

27-28 Michigan Gas Association, Mackinac Island, Mich.

JULY

11-20 University of Michigan, engineering summer conference, applied mathematics for chemical and metallurgical engineers, Ann Arbor, Mich.

18-29 Massachusetts Institute of Technology, dynamics and control of chemical engineering processes program, Cambridge, Mass.

28-30 American Petroleum Institute, Division of Production, Eastern district meeting, The Greenbrier, White Sulphur Springs, W. Va.

AUGUST

3-5 Wyoming Geological Association, field trip to Snyder basin and Wind River Mountains, Casper.

14-19 National Congress of Petroleum Retailers, Inc., annual session, Shamrock-Hilton Hotel, Houston.

15-17 American Society of Mechanical Engineers, American Institute of Chemical Engineers, heat transfer conference and exhibit, Statler Hilton Hotel, Buffalo, N. Y.

15-26 Sacramento State College, summer institute on nondestructive testing, Sacramento, Calif.

22-26 Gordon Research Conference, catalysis, Colby Junior College, New London, N. H.

29-31 Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, W. Va.

30-Sept. 2 American Association for the Advancement of Science, Alaska Division, eleventh Alaskan science conference, Anchorage.

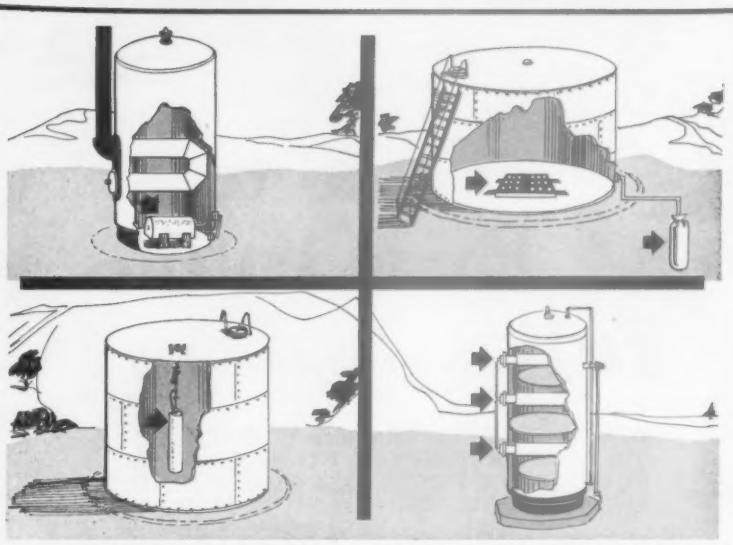
SEPTEMBER

6-7 Chemical Institute of Canada, organic chemistry division conference, Edmonton.

7-9 American Society of Mechanical Engineers, joint automatic control conference, Massachusetts Institute of Technology, Cambridge, Mass.

8-9 National Research Council, Chemical Institute of Canada, tenth Canadian high polymer forum, Alpine Inn, Montreal.

8-9 Mid-Continent Oil and Gas Association, Louisiana - Arkansas division,



HOW TO STOP CORROSION OF TANKS & HEATER TREATERS

Field experience has proved that cathodic protection offers a reliable, low-cost way to stop corrosion on steel tanks, heater treaters, filters and free-water knockouts—both externally and internally. It is effective even on vessels in contact with the most corrosive of oil field brines.

Corrosion is stopped by projecting an electrical current onto the tank surface to be protected—using either magnesium anodes or rectifiers as the current source.

The drawing shows five of the methods by which such protection can be set up. For internal protection, anodes can be suspended from the top; inserted through side openings; or bolted to or set on wooden supports at the bottom. External protection of tank bottoms is usually achieved by burying anodes in the soil near the tank.

CSI engineers are pioneers in this work. They offer expert engineering and installation services, plus a complete line of quality supplies for both rectifier and anode installations. Prices are competitive. Call or write today.

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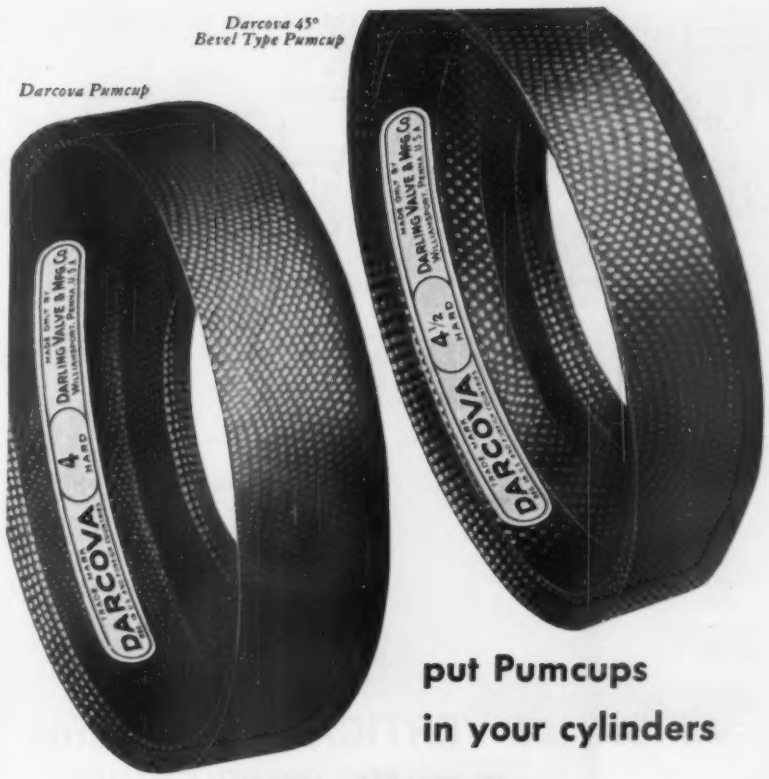
Darcova 45° Bevel Type Pumcup

Darcova Pumcup



put Pumcups in your cylinders

TO HOLD PRESSURE LONGER!

In Darcova Pumcups a sound engineering principle has been combined with precision tolerances and extremely durable compositions to provide exceptional efficiency and life in hydraulic, air, and reciprocating pump cylinders of all kinds.

Unlike ordinary piston packing, precision Pumcups are engineered to minimize friction load while hugging cylinder walls on every pressure stroke. Regardless of eventual wear, efficiency *stays* high! So there's far less down-time and need for replacement.

Pumcups are made in a wide range of sizes, types and texture-engineered compositions, including 100% Nylon, for all kinds of pressure-temperature-fluid conditions. Send for Pumcup Bulletin 5903 and weigh all the facts!

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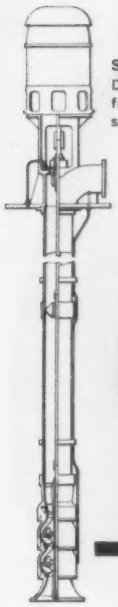
DARCOVA

THE ORIGINAL COMPOSITION CUP

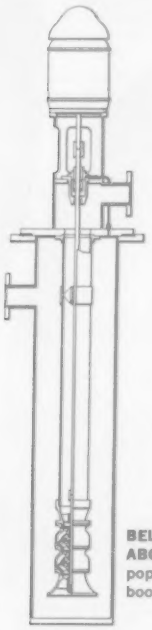
TRADE MARK

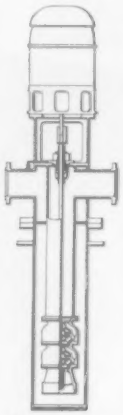
PUMCUPS

Examples of Johnston Versatility:



STANDARD UNIT—
Designed to pump from underground storage tanks.





SUCTION AND DISCHARGE ABOVE GRADE—
perfect process or in-line pump.

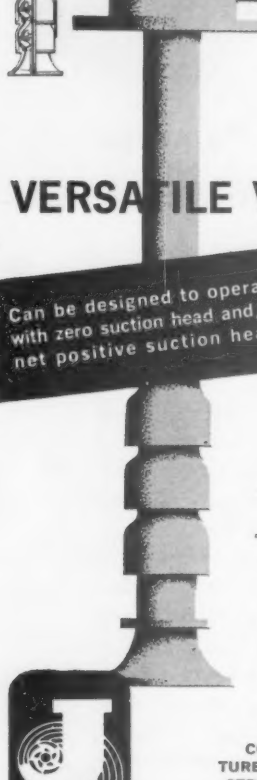
BELOW-GRADE SUCTION—
ABOVE-GRADE DISCHARGE—
popular for line booster service.

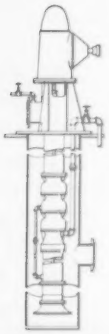
VERSATILE VERTICALS BY JOHNSTON

FOR VOLATILE FLUIDS

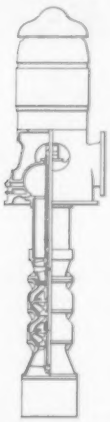
GASOLINE - CRUDE OIL - AMMONIA - L-P GASES
PIPE LINES - REFINERIES - AIRPORTS

Can be designed to operate with zero suction head and/or net positive suction head.

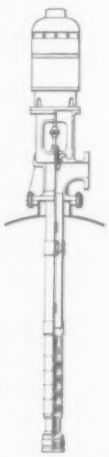




COMBINATION TURBINE-PROPELLER STRIPPING PUMP—
maximum suction lift without vapor lock.



WET PIT BOOSTER, TRANSFER OR CIRCULATING PUMP—
no expensive priming device necessary.



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For transfer of volatile liquids and chemicals.

UNLIMITED FLEXIBILITY—Johnstons fit any piping layout—satisfy virtually all pumping requirements.

CHECK THESE OTHER FEATURES: Economy of higher speeds; Non-overloading power characteristics; Steep head-capacity stability.

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A DIVISION OF THE YOUNGSTOWN SHEET AND TUBE COMPANY
3272 E. Foothill Blvd., Pasadena, California

annual meeting, Roosevelt Hotel, New Orleans.

8-10 Chemical Institute of Canada, western regional conference, Regina.

8-10 Intermountain Association of Petroleum Geologists and Eastern Nevada Geological Society, field trip, economic geology of east-central Nevada.

11-16 American Chemical Society, national meeting, New York City.

14-15 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

14-16 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

15 Natural Gasoline Association of America, Rocky Mountain regional meeting, Palliser Hotel, Calgary.

15-16 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual engineering management conference, Morrison Hotel, Chicago.

18-21 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Jung Hotel, New Orleans.

19-21 Texas Mid-Continent Oil and Gas Association, annual meeting, Hilton Hotel, San Antonio, Tex.

21-23 Pacific Coast Gas Association, annual meeting, Westward Ho Hotel, Phoenix.

23 Oklahoma Utilities Association, gas division meeting, Biltmore Hotel, Oklahoma City.

25-27 American Association of Oilwell Drilling Contractors, annual meeting, Roosevelt Hotel, New Orleans.

25-28 American Institute of Chemical Engineers, meeting, Mayo Hotel, Tulsa.

25-28 American Institute of Electrical Engineers, petroleum industry committee, electrical conference of the petroleum industry, Hotel Skirvin, Oklahoma City.

26-29 American Welding Society, fall meeting, Penn-Sheraton Hotel, Pittsburgh.

26-30 Instrument Society of America, instrument-automation conference and exhibit, and fifteenth annual meeting, Coliseum, New York.

29-30 Mid-Continent Oil and Gas Association, Mississippi-Alabama division meeting, Grand Hotel, Point Clear, Ala.

OCTOBER

2-5 Society of Petroleum Engineers of AIME, annual fall meeting, Denver.

3-4 Independent Natural Gas Association of America, annual meeting, Fontainebleau Hotel, Miami Beach.

5-7 Four Corners Geological Society, third field conference, registration, October 4, Moab, Utah.

6-7 National Association of Corrosion Engineers, annual western region conference, Sheraton-Palace Hotel, San Francisco.

6-8 National Association of Corrosion Engineers, southeast region conference, Dinkler-Plaza Hotel, Atlanta, Ga.

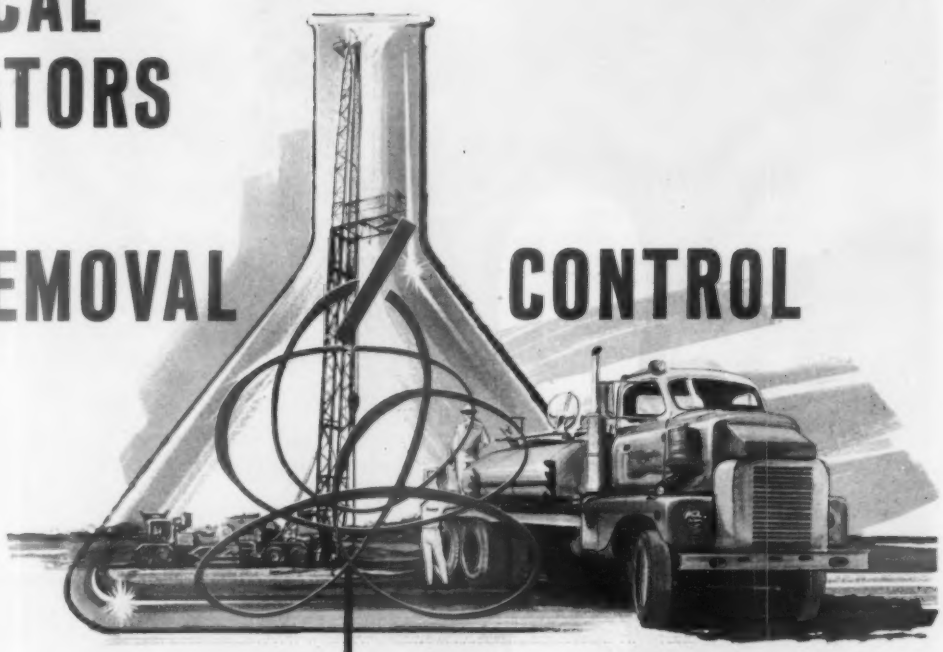
6-8 National Academy of Sciences, National Research Council, ninth national clay conference, Purdue University, Lafayette, Ind.

10-12 American Gas Association, annual convention, Atlantic City.

11-14 National Association of Corrosion Engineers, northeast region conference, Prichard Hotel, Huntington, W. Va.

12-14 Southwestern Federation of Geological Societies, annual meeting, Wooten Hotel, Abilene, Tex.

CHEMICAL ACTIVATORS FOR GYP REMOVAL CONTROL



REMOVE GYP CHEMICALLY!

Halliburton's *new Gyp Removal Solution* is designed to penetrate normally insoluble gyp scale (calcium sulphate) . . . and convert it into an acid soluble scale which can be removed by conventional acid treatments. This remarkable advance helps eliminate the costly task of pulling tubing to remove scale.

CONTROL GYP CHEMICALLY!

Scalechek is Halliburton's technique of placing SCP materials, scale control polyphosphates, into a producing formation to help provide protection against gyp deposits and other scales for extended periods of time at temperatures up to 260°F. Scalechek materials may be injected in conjunction with a fracturing operation . . . or it may be injected without sand.

These two chemical processes are now in wide use as a part of Halliburton's continuing program of providing the Petroleum Industry with fast, efficient help . . . anytime . . . any place it is needed. Your local Halliburton Representative is your link to this chain of service. Contact him on your next job calling for creative chemistry.

REMOVE GYP CHEMICALLY!

CONTROL GYP CHEMICALLY!

"Continue to Look to Halliburton for Leadership."

HALLIBURTON CHEMICAL SERVICES

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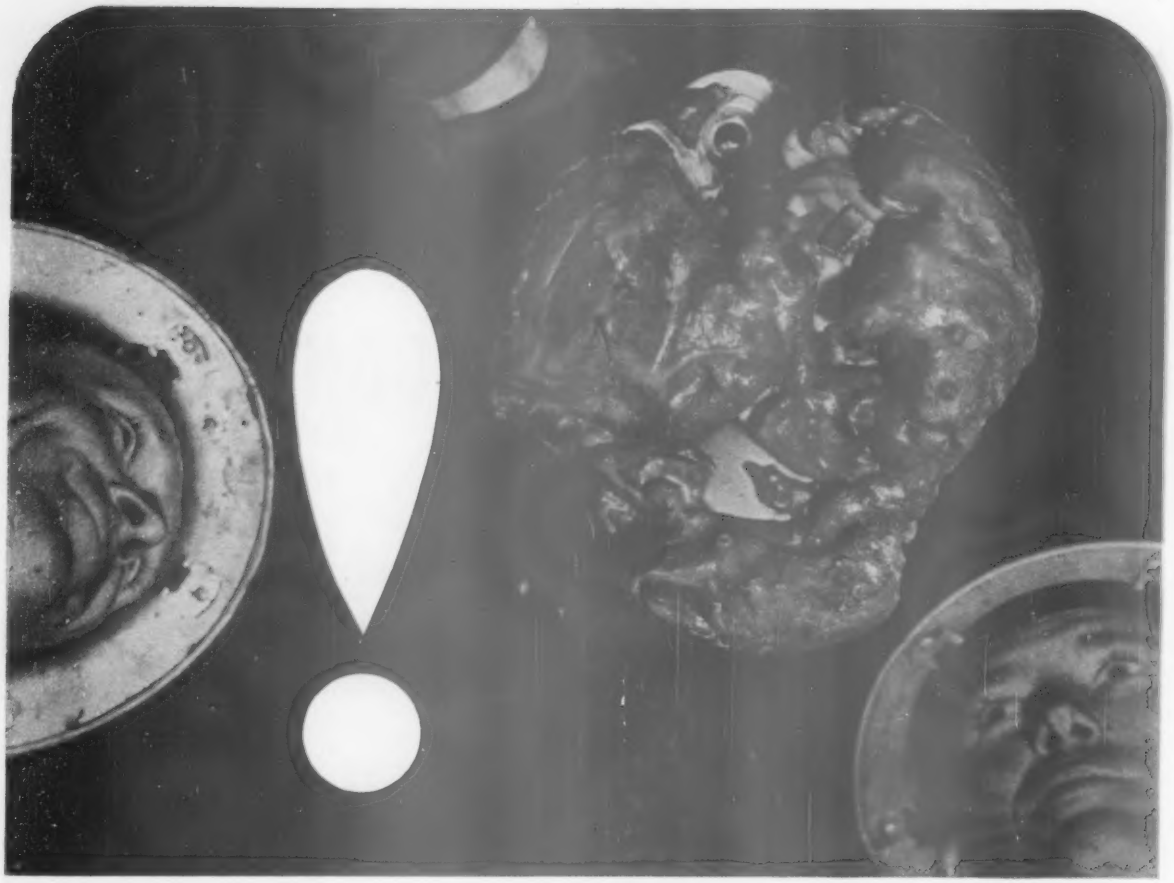

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Only through such coordination can uniform standards be extended from a local or regional level to one of national or international scope. In product quality, dependable delivery and engineering skill, you get Baroid excellence whether your well is near Coalinga or Casper; Corpus Christi or Crowley; Caracas or Calgary. *You save drilling dollars* with a Baroid Mud Program!

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5048

50 years ago

June 16, 1910

The most interesting place just now west of the Mississippi River is the development at Caddo, in northwestern Louisiana and Northeast Texas, which bears all the marks of an important oil field, 10,000-bbl. wells showing oil equal to the high-grade Pennsylvania crude.

W. C. Norris, of Tiona, Pa., is starting a factory in Tulsa to manufacture sucker rods, pull rods, and specialties for oil-well use. The factory will be ready for work in about 60 days.

The Texas Co., during an electrical storm May 21, lost a 37,000-bbl. iron tank at Sour Lake, Tex., containing Oklahoma distillate, entailing a serious loss.

25 years ago

May 30, 1935

By the unanimous action of the Supreme Court invalidating the National Industrial Recovery Act, it is believed that the defeat of the Thomas oil-control bill is assured, as is also the Wagner labor-relations bill, the 30-hour work-week bill, and others which rely upon their "effect" upon interstate commerce as their basis.

Retail-service-station prices of gasoline, which have followed a steady upward curve since November, now average 13.86 cents exclusive of tax. The sharp upward trend since May 1 indicates that the average price may reach 14 cents by the end of the month.

The world's deepest test, Gulf Production Co.'s No. 103 McElroy, Section 197, Block F, on the west edge of Upton County, Texas, is preparing to abandon after running the Schlumberger at total depth of 12,786 ft.

10 years ago

June 1, 1950

One of the petroleum industry's most widely known figures, Harry F. Sinclair, is retiring under the pension plan of the organization he founded 34 years ago. He will continue as a director and also be available as a consultant in the company's affairs.

Ten years of gasoline rationing in England ended last week under a deal whereby American companies will supply a larger share of the market by taking payment in sterling which may be used for the purchase of goods and services in the sterling area.

First discovery of oil in the northern half of Trinidad in an exploratory well of United British Oilfields of Trinidad, Ltd., has been reported from Port of Spain.

JOURNALLY SPEAKING

The British View

FROM their vantage point across the Atlantic, British observers sometimes take a more detached and objective view of the American scene than is possible here.

For instance, we frequently read with great interest the comments on the U. S. oil industry in a British petroleum publication which crosses our desk now and then. The writing style may be more leisurely and more scholarly than the Yankee brand of journalism, but the observations are none the less pointed.

Last August one such so intrigued us that we tore it out and stuck it in the bottom drawer. Last week it came to light, and on rereading it seemed every bit as pertinent now as then. It was headed:

"Why Texas is Back to Nine Days."

After noting some cuts in crude prices although Texas had set allowables at only 9 days in both July and August, the article said:

"Recent declines in U. S. prices are symptomatic of a deeper malaise than appears on the surface.

"For years U. S. independent producers have preached the sermon that all would be well if only imports were held down. Since March (1959) imports have been held down severely . . . Yet the U. S. industry, so far from experiencing a new era of prosperity, has been subject to continuing erosion of product prices and to fears of a further fall in crude prices to follow.

"Indeed, to some extent, the imports controls have themselves contributed to this situation. Victims of their own propaganda, some U. S. operators may have been too ready to believe that with imports under control, it was inevitable that production should be expanded, and that the customary cautionary eye on the markets could be relaxed.

"To counteract these developments the Texas Railroad Commission has had to resort to the only available remedy of sharp cuts in allowables. . . Allowables in other producing states where production is limited to market demand are also well below capacity. . .

"With imports on a tight rein, some operators are attributing their difficulties to increasing production in states not having pro-rationing. . . An important factor in the growing problems of U. S. crude producers is the now increasingly recognized fact that the rise in production of natural gas and natural gas liquids has been far more significant than the growth of imports. . .

"Equally fundamental as a cause of the industry's difficulties is the character of leasing and pro-rationing practices, based on the law of capture. As a consequence, despite the discouraging facts that the number of producing days of pro-rationed wells in Texas has fallen persistently down the years, and that the success of drilling has steadily declined, the number of crude producing wells in Texas continues to grow. . .

"The share of non-pro-rationed production has steadily increased, so that nine producing days are now accompanied by a total allowable of 2.7 million barrels per day, where only as recently as March last year (1958) nine days was accompanied by an allowable of 2.5 million barrels per day.

"The problem essentially is that while pro-rationing can prevent overproduction from existing wells, it does not concern itself with limiting the number of producing wells itself, but has the effect of encouraging the drilling of more wells. This is an oversimplification of a complex problem, but it gets to the heart of the matter.

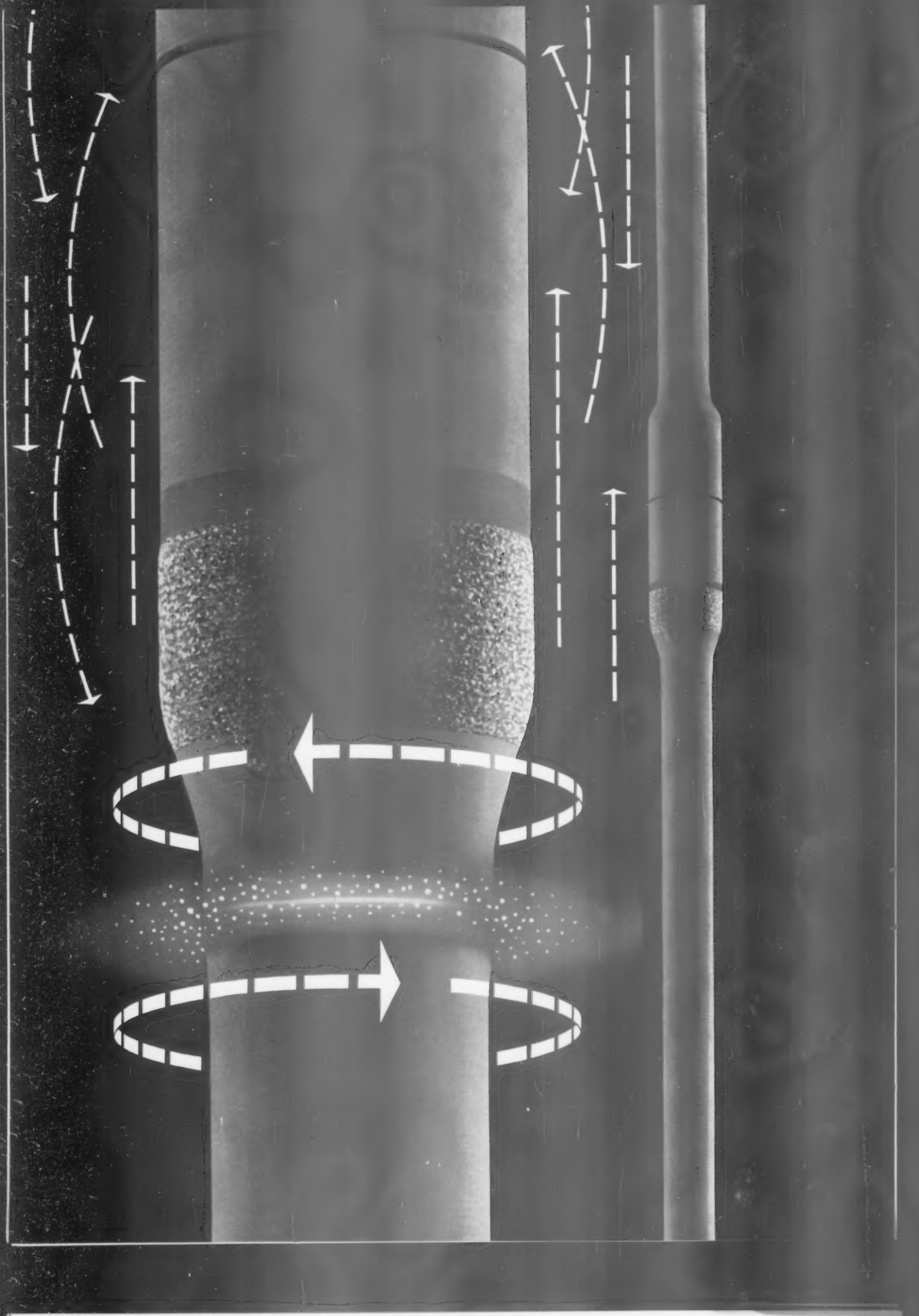
"The existing system assures a share of the market for each successful well, the volume of which is still big enough to encourage the drilling of further wells, even though the capacity of those already drilled is quite sufficient to meet prospective demand. . .

"Looking at this picture in the round, a large surplus capacity seems likely to persist indefinitely both in Texas and in other pro-rationing states. Operations under these conditions will continue to be profitable, but much less so than they could be. . . "

That was written last year just after Texas announced its second consecutive month of 9 days.

Last week Texas announced its second consecutive month of 8 days.

—Henry D. Ralph.



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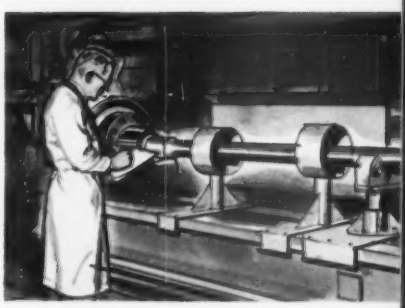

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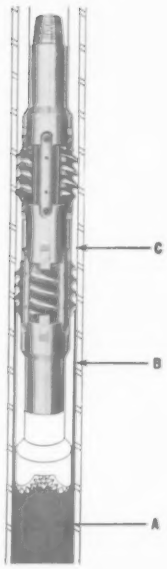

A – Cement to be drilled out.
B – This thin cement sheath, which remains after the bit has passed, often interferes with future operations.
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BAKER OIL TOOLS, INC. HOUSTON LOS ANGELES NEW YORK

Oil's practices don't match its preachings

THERE ARE SITUATIONS in the oil business today that a cynic might describe as hypocrisy.

Top leaders make pious statements about industrial statesmanship and responsible management, while their own companies privately continue doing the things the brass publicly deplore.

The pots all call the kettles black. In analyzing what's wrong with the industry, oil men dwell on the mote in their brother's eye but perceive not the beam in their own.

FOR INSTANCE:

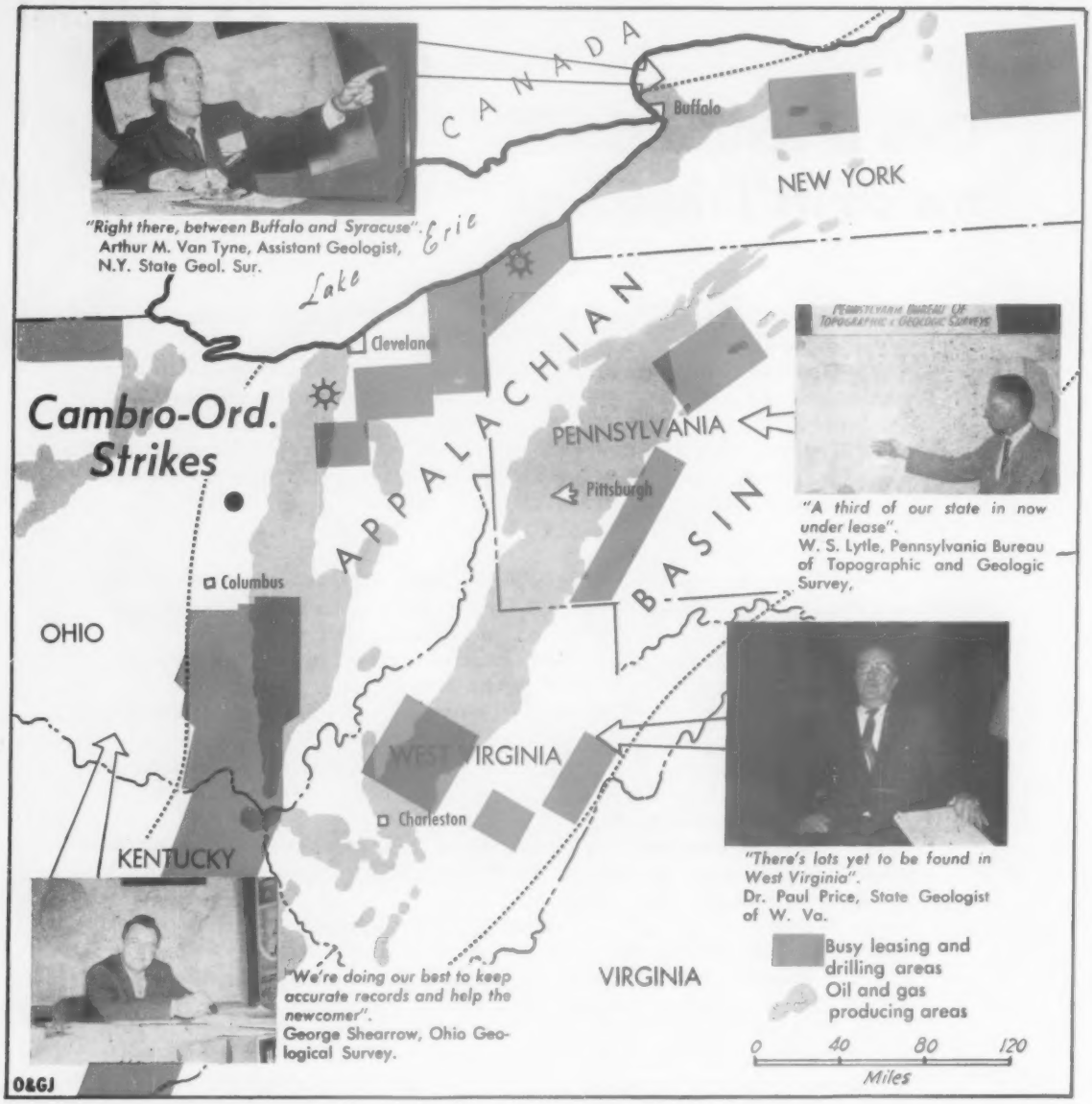
- More than a few majors who condemn price cutting, secretly own chains of private-brand, cut-price filling stations, or control formerly independent outfits that continue to cut prices under their old names.
- Any week that several refiners announce cuts in their refinery runs it is a safe bet that the API report will show an increase.
- All refiners say that the industry's runs and stocks are alarmingly excessive but that their own are safely in balance.
- Independent producers condemn refiners for pursuing the incremental barrel through maximum runs, but say they can't afford to curtail their crude output because their unit costs would rise.
- Historic importers charge that inland refiners can use their quotas to subsidize price wars, but they themselves have bigger quotas and thus are in even better position to cut prices.
- Independent marketers who grew by sharp practices and questionable ethics complain that the majors are now doing the same thing.
- Majors preach efficiency to independent marketers when their own marketing practices may be grossly obsolete and inefficient.
- Established marketers seek to maintain the historic position of their advertised gasoline when their stations are poorly located and offer no better convenience, service, or quality than the price cutters they condemn.

AND SO IT GOES.

But rather than hypocrisy, a more charitable—and more reasonable—explanation is shortsightedness and clinging to old habits.

Few men in the industry have thought through the changed conditions in the oil business and the adjustments they call for. In big companies the right hand doesn't know what the left hand is doing. Among independents there is a feeling that the majors alone should solve all problems.

Neither pious statements nor name calling will cure the present dog-eat-dog competition. Oil men must practice what they preach.



APPALACHIAN DRILLING so far in 1960 is ahead of 1959. Despite this, however, it is a case of . . .

Much smoke, little fire coming out of the Appalachians

"but one of these days the flames will catch"

Frank J. Gardner
Exploration Editor

"STOP LOOKING for 3-dollar oil and start looking for gas."

That's the word among operators in the Appalachian basin today.

And why not? It makes sense to search for 25 to 32-cent gas when the pools are shallow, drilling is cheap, and buyers are waiting.

The stepped-up drilling activity in all Appalachian states during the past 2 years is only a taste of what lies ahead. Unlike many regions, 1960 drilling so far is ahead of 1959. Nothing of boom proportions is yet apparent, however.

Here's the picture in five states:

... Ohio. "In my opinion, this is only a lull before the storm." So says one prominent Ohio independent who is busily signing up leases.

... West Virginia. "I've had more drilling applications cross my desk in the past 3 months than at any similar time since 1929," says Marie Griffith, head of the Oil and Gas Division of West Virginia.

... Pennsylvania. "We saw over 2 million acres leased in 1959. Today, about 10 million acres, or one-third of our state is under lease, and you can look for a drilling boom from here on out." That's the situation in Pennsylvania, according to the State Geological Survey in Pittsburgh.

... Kentucky. "The very fact that oil is so close to the surface in Kentucky should convince us that much more remains to be found at deeper levels," says a consultant in Ashland.

... New York. "We used to have 20 or 30 wildcats per year. In 1959 we had 39, and we look for more than that in 1960." Such is the situation in the Empire State, according to the State Geological Survey.

Changing trend ... All this optimism adds up to one thing: there'll be a renaissance throughout the Appalachian basin in the next 5 years, and if it pays off as these authorities expect, a 100-year trend will be reversed as wildcatters move from southwest to northeast.

"These invaders from the Southwest are already with us," says one old-timer in Columbus, Ohio. "They think we're behind the times, but we're not really. We have our programs planned for the next 5 years. Our activities are well-directed, and we don't need those extra contractors who keep coming up here looking for work. We have our own contractors to take care of first."

Go up the street a few blocks and talk to another operator, newly arrived in Ohio, and he says, "Why, do you know that on one of the deepest wells drilled in this state the well-site geologist was equipped with a hand lens to examine the cuttings? Some of these companies didn't even have geologists until 5 years ago."

It's the new versus the old. But it's the new that has revitalized Appalachian operations and made producers out of dry holes, tapped new reservoirs deeper than the old ones, and convinced the industry that our oldest oil basin still has a lot to offer. Formation fracturing, air drilling, rotary tools, the implosion and hydrosonic concepts, gamma-ray logging—these are just a few of the twentieth-century techniques that are being applied in this nineteenth-century laboratory.

A Case History...

Take a look at the operations of one independent in Pennsylvania:

Along the southern shore of Lake Erie, Worldwide Petroleum Co. of Fort Worth has leased 70,000 acres on a trend along the lake shore between the Ohio and New York state lines. Five men are actively leasing with a goal of 100,000 acres at 25 cents per acre.

So far, three Clinton wells have been drilled at $33,000 each, complete. They went to 3,100 ft. and all three were producers. The gas sells at 32 cents (this varies with the weather). Operators expect to recover 250 to 500 M.M.c.f. per well. They pay $4.25 per foot for drilling.

This is a strat-trap play, and you've got to drill fast and cheap to feel it out. "We look for a big play in the Appalachian area because large independents are fed up with overregulation in the Southwest, and they're moving in up here," says a spokesman for Worldwide.

This operator uses subsurface geology exclusively to find its reward. "The sands correlate very well across long distances, and it's not too hard to spot the pinchouts. The gas is great, and we intend to look for it, but we need a big oil-pool discovery to really set this state off on a new deep sub-Trenton play."

All this interest and activity can lead to only one thing for Pennsylvania—a new era of exploration.

Ohio

Ohio is showing the way. Ninety per cent of all drilling there is done by independents, and it's doubtful that the picture will change soon. But success breeds success, and likely the new boom in the Appalachians will be launched here.

It pays to find gas in Ohio. Prices run from 24 to 27 cents per M.c.f. Oil brings $2.72 per barrel. There's a ready market for nearly every producer, and if it isn't there when the well is finished, all you do is wait a while.

To some Southwesterners, these Ohio operations may look like peanuts, but economically they're attractive.

"You must remember," says one operator, "that the economic picture in the Appalachians is entirely different from that in the Southwest. You think in terms of billions of cubic feet, while we think in terms of millions. That's one reason we use cable tools—it is a simple matter of economics."

Drilling is 99% cable tool in Ohio. Last year there were only 10 rotary operations in the state.

Leasing up ... Land men are busiest today in Pickaway, Ross, Pike, and Scioto counties in South Central Ohio, where 100,000 acres have recently been inked. Another active lease play centers in Vinton, Hocking, Fairfield, Jackson, and Lawrence counties in the same vicinity.

The lease picture generally is rather tight, but farmouts and deals are readily available. The average going price is $1 an acre in active drilling areas and 25 cents in those that are off the beaten path; the average rental is 25 cents.

In addition to the counties already mentioned, those bordering Michigan are seeing some new activity—a reflection of the highly interesting Scipio trend play in southern Michigan.

" . . . new companies move into Ohio every day . . . "

Who's there . . . The two largest operators in Ohio are Ohio Fuel Gas Co. and East Ohio Gas Co. Both say they have cut their drilling program for the current year, both for exploratory drilling and for storage wells. Ohio Fuel cut its program from 90 wells over-all down to 23, and its storage program from 100 to 20 wells. This would seem a contradiction to the optimism heard elsewhere, but it's a reflection of general economic conditions.

New companies move into Ohio every day, and drilling should perk up soon. Humble Oil & Refining Co. Carter Division, Kewanee Oil Co., and Continental Oil Co. are all interested and have been active both in leasing and drilling.

In total drilling, the two most active counties today are Wayne and Ashtabula in the northeastern part of the state. Phillips Petroleum Co., with a 70,000-acre block, recently announced a 10-well wildcat program for this region, with some wells scheduled for neighboring Portage and Trumbull counties.

Sun Oil Co. holds 100,000 acres in scattered blocks and is expected to launch an extensive drilling program soon. Other major operators in the state include: Gulf Oil Corp. (50,000 acres); Ohio Oil Co. (50,000 acres); and Mobil Oil Co. (250,000 acres). Ohio Fuel holds 700,000 acres, and East Ohio a like amount.

Many objectives . . . The chief target is Clinton-Silurian gas, but deep digging can be expected in a search for older reservoirs.

A 3,300-ft. test in the northeast is adequate for Oriskany-Devonian and Clinton-Silurian. Wells in Wayne County (site of 50 active locations) produce from three principal pay zones—Berea-Mississippian, Newburg-Silurian, and Clinton to depths of 3,400 ft. Other active drilling campaigns are centered in Vinton County with 18 active wells aimed at the Clinton to depths of 2,800 ft. Drilling rates average $2.65 per foot.

Ohio also has a depth complex, and general opinion is that future exploration will probe to the basement where possible. The outlook is greatly encouraged by two recent discoveries, both productive from Cambro-Ordovician rocks. One is a gasser in Medina County (southwest of Cleveland). The other, an oil strike, is in Morrow County in the central part of the state.

"You might be interested to know that the Morrow discovery didn't come from geology, but from a wiggle stick," joked one oil finder.

So some nineteenth-century techniques still work. Nevertheless, the very existence of two Cambro-Ordovician pools, plus a third in northwestern Pennsylvania, lends credence to the belief in Early Paleozoic treasure yet to be found all over the basin.

"We need a sub-Trenton play, and I feel sure that it's on the way; it's long overdue." This is the opinion of more than one operator in Ohio.

Very little seismic work is going on now. "There's little use for seismic except possibly to spot deeply buried truncations," says one geologist.

State offices cooperate . . . Ohio has no proration or spacing rules. A drilling permit is required, as well as a plugging report.

"The Ohio Oil and Gas Association hopes to avoid too much state regulation via education of the operators and voluntary self-regulation," says one member of that organization. The usual spacing pattern now varies from 60 to 80 acres for gas and 20 to 30 acres for oil.

"We're doing our best now to keep up-to-date records. So far, exploration in Ohio has been helter-skelter all up and down the road. But our survey is lending all possible help to newcomers in hopes that a new competitive spirit will prevail." That's the attitude of R. J. Bernhagen, state geologist of Ohio.

And the records kept in the survey office, under the direction of George H. Shearrow, are indeed impressive. Rows of file cases and map racks attest to the work that has been and is being done. Completion records on all deep wells are available for public examination and reproduction. Completely posted maps of Ohio townships may be purchased from the survey.

"Our deep-well cards are about worn out," says Shearrow. "During the past couple of years, this has been one of the busiest offices in town. We want to help the operators as much as we can by furnishing accurate records in the way of completion cards, maps, and logs. About 30% of all Ohio wells are logged electrically or by gamma ray. This is quite an improvement over the old days."

Apparently, offshore Lake Erie prospects are a dead issue in Ohio. "Economically it's unsound, even though we know the production is out there," says one operator. "Our state agencies studied the possibilities, but they demanded too much, and the thing never got off the ground. Then, too, the municipalities along the shore objected on the grounds of water pollution, the fishing people opposed it, and the Coast Guard opposed it. So what can you do?"

Pennsylvania

Over in Pennsylvania, the picture is a little different. The same optimism is met as far as future prospects are concerned, but the deep campaigns are already on, and Pennsylvania operators have some tangible evidence of the rewards to be found in the deeper rocks.

For the past 5 years, deep drilling in this state has buzzed along and with considerable success. The focal point up until now has laid in Clearfield and Elk counties where 80 deep Oriskany tests have been finished, about 70 of them as successful gas producers. The average depth here is 7,100 ft.

The principal objective in this area is the stratigraphic pinchouts of the Oriskany-Devonian on the flanks of long, narrow anticlines such as the Sabinsville structure. In some cases, the sand simply tightens up over the crest of the anticline while in others the structures are baldheaded.

Other successful gas hunts have been staged in northwestern Pennsylvania along the shores of Lake Erie and in the counties of the southwest (Fayette, Indiana, Westmoreland, and Somerset). The northwestern play is a shallow one aimed at the Clinton at 3,100 ft., while the southwestern play is another deep one to Oriskany at depths of 7,300 to 8,500 ft. The deepest producing well in Pennsylvania is located in Boswell field, Somerset County, where the reservoir is Onondaga-Devonian at 8,472 ft.

Indicative of the interest now being expressed in Pennsylvania after 100 years of steady production was the 1959 drilling record—124 deep wells were drilled and 90% had the Oriskany as a target.

Majors move in . . . Pittsburgh has taken on the appearance of a growing oil and gas center in the past 2 years as major oil companies have moved in and opened exploration division offices, well staffed and equipped for a serious search.

Shell Oil Co. has 30 men in its Pittsburgh office and is doing a great deal of seismic work in the central part of the state. Gulf and Pure are taking a look. Continental is engaged in an active leasing campaign in the southwestern counties. Phillips has

drilled half a dozen wells in Potter County, and Kerr-McGee Oil Industries, Inc., is actively leasing in the southeastern part of the state.

Other companies which have opened exploration offices in recent months include Humble, Mobil, Tidewater Oil Co., and Sun. Geological Sample Log Co. and Appalachian Logging Service are two newcomers in the field of service organizations.

So far, the bulk of deep drilling has been done by New York State Natural Gas Corp., Peoples Natural Gas Co., and Manufacturers Light & Heat Co.

During 1959, over 2 million acres of land were leased in all parts of Pennsylvania, and seismograph crews were actually scarce.

All of this exploratory rumbling leads authorities of Pennsylvania state agencies, who keep close tabs on such goings on, to predict a coming boom in drilling, perhaps in every corner of the state.

No drilling permit is needed in Pennsylvania unless a workable coal measure is involved; then a permit from the Oil and Gas Division of the Department of Mines is required. Completion reports are required by law, but as a matter of practice they are not always forthcoming. A bill now is pending in the state legislature to require drilling permits and to set up spacing regulations for future Pennsylvania drilling operations.

A slow start . . . The renaissance in Pennsylvania really began with the discovery of Leidy field in 1950. This Clinton County field was the setting of the famous Finnefrock well, a 145-M.M.c.f. producer, largest ever completed in the eastern states. New York State Natural drilled it.

Later came the Driftwood-Benezette discovery in 1951. Further exploration moved the play southwest into Cameron, Fairfield, and Elk counties, where the play centers now.

Southwestern operators moving into Pennsylvania must acquire a new perspective concerning gas production and reserves. The average life of a gas field here is only 2½ to 5 years. After depletion, they are usually converted to storage reservoirs. The Oriskany and Onondaga are noted for quick depletion; this, combined with the unrestrained competitive drilling, is the reason for the short life of the fields. Leidy field produced 100 billion cubic feet before conversion to storage. Of this total production, approximately one-third came from the Finnefrock well alone.

But they are profitable operations. The gas sells for 27 cents, and well costs vary from $80,000 to $125,000. Drilling costs $6.50 to $7.50 per foot, and rotary tools are employed. About a dozen rotary rigs are whirling now in this deep Pennsylvania area. Air drilling is widely used.

The shallower cable-tool operations cost about $1.50 to $1.65 per foot, and an 1,800-2,500-ft. well costs about $4,500 plus fracturing expense of about $2,500.

Glenwood Discovery Indicated in Ohio

OHIO MAY HAVE its second oil discovery in the Glenwood sand of Cambro-Ordovician age. Indicated discovery is the Graver 1 Ben Fisher in Violet Township, Fairfield County.

Test had a good show of oil in 20 ft. of pay at base of the Glenwood at 3,226 ft., with a show of gas. Casing has been cemented to total depth of 3,330 ft. Decisions on zones to perforate and type of treatment for the pays await evaluation and interpretation of the logs.

Only other Ohio producer in the Glenwood was completed last year as the Monk discovery in Morrow County. That well made 100 bbl. daily from 3,589-91 and 3,606-17 ft. Some geologists rate the Graver well as having a better potential than the Monk.

West Virginia

Another Appalachian state now poised for an upswing in drilling is West Virginia. Here, too, deep Oriskany wells on long, narrow anticlines have set the pace.

Established operators in these hills include Columbian Carbon; Godfrey L. Cabot, Inc.; Hope Natural Gas; United Fuel Gas; United Producing Co., Inc.; South Penn Oil Co., and other smaller organizations.

The newcomers are here, too. Among them are Shell, Pure, Sun, Gulf, Humble, Phillips, and J. M. Huber—all with offices in Charleston.

"Exploration here is mostly hit-or-miss subsurface probing," explains one major-company geologist. "The geology is extremely complex, and as far as deep-well records are concerned, they are practically nonexistent."

Some seismic activity is evident in West Virginia, principally in the western counties, and observers expect to see an increase in this type of exploration in the future.

Four or five rotary rigs are constantly in use, and drilling costs average $6 a foot with a finished well tagged at $75,000 or so, to a depth of about 6,500 ft.

Of 10 deep wildcats drilled in West Virginia in 1959, four opened new gas fields; average footage came to 7,185.

Fields rewarding . . . One of the most interesting fields found in West Virginia in recent years is the Glady reservoir, Pocahontas County.

It is the most active area at the moment, and 29 gassers have been finished with production running around 20,000 M.c.f. per day. Only three dry holes have been drilled. The reservoir is Oriskany at about 6,200 ft. An unusual field, it stretches for 16 miles northeast-southwest and is only a couple of miles wide.

Another deep field in Jackson County has six Oriskany producers at 6,100 ft. or deeper.

A couple of other areas in Nicholas County and Kanawha County have attracted attention. The one in Nicholas County is a Mississippian reservoir at 2,000 ft. with 6 producers out of 11 wells drilled. The Kanawha County field is Point Creek with Weir sand pay at 2,100 ft.; here 14 wells have been finished and 4 more are on the books.

Enthusiasm waxes hot in West Virginia, partly because of the success of recent years, and partly because of hopes for even deeper production from Cambrian and Ordovician reservoirs. As in Pennsylvania, the Oriskany fields are short lived, but the gas sells for 16 to 25 cents per M.c.f. and condensate brings $2.56 per bbl.

"There are many newcomers to this state," says Marie Griffith, head of the Oil and Gas Division, "and I see new names every day. It looks as though we are in for a real drilling boom."

West Virginia has no proration, no spacing rule, but a drilling permit is required as well as a plugging permit. The state encourages expansion of the industry, and looks forward to an active decade ahead.

New York

Exploration fever is also breaking out in the counties of southern New York. Here activity is focused on the Medina-Silurian trend where gas may be found at 2,000 to 3,000 ft.

In the south central counties, Oriskany gas is the principal target at depths of approximately 4,000 ft., although some wells have gone to 6,000 and 7,000 ft. It was in this vicinity that New York State Natural drilled its depth-record breaker Olin well to 13,500 ft. in 1958. This was in Steuben County, and is the deepest well ever drilled in the Appalachian basin. Complete dope on it has never been released, but it ended in transi-

tion rocks overlying the Precambrian.

Operators in New York are clustered around Ontario County, where small structures give indications of new Medina production and indicate a future play in this part of the state. This is in the center of the general Medina trend between Buffalo and Syracuse.

As for deeper possibilities, New Yorkers look to the Trenton-Ordovician and Theresa-Cambrian. There is no Cambrian production in New York yet, but wells that have penetrated the Theresa have found a good porous sand with strong flows of salt water, which lends hope to the belief that it could be an oil reservoir of importance.

You don't need a drilling permit in New York, and they've no proration system nor spacing rules. It's free country.

Upswing is due . . . Among companies taking a new look at New York are Shell, Tidewater, South Penn, Benedum-Trees, and Devonian Oil & Gas Co. Conoco and Kerr-McGee as well as Phillips are said to be nosing around, doing some dickering for acreage and a little seismic work.

Older companies in the state include New York State Natural and United Carbon Co.

Those counties in the limelight at the moment, as far as leasing is concerned, are Otsego, Madison, and Oneida; these lie east of previous production and any drilling there would be strictly wildcat operations.

The New York State Geological Survey anticipates a record drilling year in that state for 1960, and this may well come to pass.

Of seven wildcats so far in 1960, two have opened new gas reservoirs.

Eastern Kentucky

While the big play in Central Kentucky doesn't lie within the limits of the Appalachian basin, there is little doubt that its very existence has drawn the attention of many western oil men to the possibilities of all Appalachian states.

That part of eastern Kentucky which does lie within the basin is fairly active on the leasing front, and a good deal of drilling is going on. The play centers on the east flank of the Cincinnati arch, and new fields and extensions are being found every day in the coal country around Breathitt County.

More than 2 million acres of land is now under lease in the area east of the Cumberland Forest and lying between the Tennessee border and the Ohio River. The chief target again is gas, but oil is also being uncovered. Local companies are very active, but many newcomers are on the list.

Among these, one of the most active is Hunt Oil Co. which has launched a widespread geological study and has signed up 400,000 acres or so in 19 eastern Kentucky counties.

Lease prices run the gamut here from 25 cents to $5 an acre, with most land going for $1.

Established Kentucky operators include Kentucky-West Virginia Gas Co., Ashland Oil & Refining Co., Equitable Gas Co., and United Fuel. Nearly everything is done with cable tools but some rotary drilling is going on, and more is anticipated.

Davis to Insist on Prosperous Oil Industry

• Louisiana governor asks extension of gas-severance tax, hangs budget hopes largely on income from sales of leases.

LOUISIANA'S Jimmie Davis, who this month took over the governor's chair for the second time, is well aware that the health of Louisiana depends on the health of the oil industry.

In his budget message to the legislature last week, Davis said the industry "must prosper" and that "any setback in the progress of this industry would greatly cripple our annual income."

Davis based his proposed budget partially on a continuation of the 2.3-cent gas-severance tax, which expires automatically in August unless renewed by the legislature. He estimates $55 million annually from the levy.

Davis also is counting on a net of $20 million from the sale of oil and gas leases on state lands. This would make up a deficit of that amount in the budget.

Most of Louisiana's critical money problems, which grew out of the spending policies of the Earl Long administration, could be solved by a favorable ruling from the U. S. Supreme Court on the tidelands issue. If the court holds Louisiana's offshore border extends 10.5 miles into the Gulf of Mexico, the state eventually would receive the bulk of some $340 million now held in escrow for the state and federal governments.

Personnel . . . Davis last week had not disclosed what he intends to do about key administration appointments affecting the oil industry.

The 15-member state mineral board, which handles leasing, serves at the governors pleasure. William G. Helis, New Orleans independent, is chairman of the board and was a key Davis supporter during the recent campaign for governor. It is understood Helis can retain the job if he wants it.

Still clouded is the future of Ashton Mouton, conservation commissioner who had broad powers to set allowables and administer the state's conservation laws. Mouton's resignation is available if Davis wants it, although the commissioner would like to stay on. Charles Mayer, a Shreveport attorney, is reported under consideration for the job.

Davis last week was pushing for fast action on the severance-tax bill, despite opposition from two business organizations—the Louisiana Chemical Association and the Louisiana Manufacturers Association.

The chemical group, composed of the top processing companies in the state, proposed cutting the rate from 2.3 cents to 2 cents this summer and then to 1.5 cents on July 31, 1962. Expansion of gas production would make up for the drop from 2.3 cents to 2 cents, the association believes.

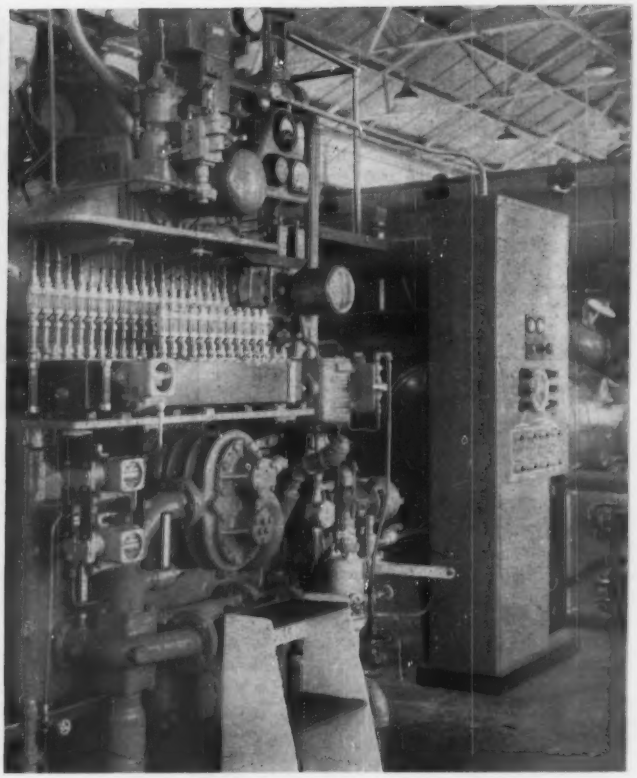
The manufacturers said the tax is a deterent to new industry in Louisiana and cited figures showing that the state has suffered a net loss of more than 19,000 manufacturing jobs in the past 7 years despite plant expansion. The house ways and means committee nonetheless approved the bill reenacting the tax.

No controversy . . . Except for the tax measure, the new Louisiana legislature had little controversial oil and gas legislation before it.

Sens. A. C. Clemons, Jennings, and Guy Sockrider, Lake Charles, introduced a bill to clarify and strengthen the conservation commissioners authority to order unitization of pools for secondary recovery and recycling. The bill specifically authorizes the commissioner to initiate such unitization projects on his own motion.

Another measure would amend the state constitution to tie up any tidelands escrow money going to the state. The money would go for debt retirement and capital spending.

CONTROL CONSOLE and monitor in Colorado Interstate's communications center. At left is N. B. LauBach, CIG vice president of operations. At right is G. A. Peck, president of Southwestern Industrial Electronics.



ENGINE CONTROL panel at right governs operation of engine at left. Panel is one of four at Colorado Interstate's Springfield station. Control console (left photo) serves as "operations manager" of the system, passes orders down to engine-control panels, which direct performance of the compressor engines.

Satellite Compressor Station Started Up

- Colorado Interstate shows latest in push-button operation of gas lines with nation's first "remotely supervised automatic station." More will follow.

STEADY PROGRESS is being made in gas-pipeline automation.

The first transmission system built for push-button operation from the start—Transwestern Pipeline Co.'s Texas-California line—will be completed this summer.

Columbia Gulf Transmission Co. will automate its gas-engine reciprocating compressor stations this year. Columbia Gulf's remotely controlled gas-engine centrifugal stations, pioneered in 1955-56 (OGJ, Aug. 16, 1956, p. 66), were the models for Transwestern.

Texas Eastern Transmission Corp. is remotely operating both gas-turbine centrifugal and gas-engine reciprocating stations (OGJ, Nov. 10, 1958, p. 96, and April 27, 1959, p. 96). Tennessee Gas Transmission Co. also has a remotely operated gas-turbine centrifugal station.

Last week, Colorado Interstate Gas Co. joined the parade, and introduced a control system new to gas pipelining. This type of control will also be incorporated at stations planned in its $91-million expansion program pending before the FPC.

CIG satellite . . . CIG started up at its Springfield, Colo., station the first telemetering and control system using solid-state (transistorized) electronics equipment.

The company describes it as the "first remotely supervised automatic compressor station." It is supervised from the communications control center at company headquarters in Colorado Springs, Colo.

N. B. LauBach, vice president in charge of operations, pointed out the difference between CIG's and other control operations.

In the Springfield automatic supervisory-control system, all station regulating functions, including engine selection, are under the direction of controls within the station. In a remote-control operation, the dispatcher manipulates the controls.

LauBach said the Springfield station and similar satellites planned fit a company policy calling for "that degree of automation which brings about the maximum utilization of equipment and personnel at the lowest over-all cost of service."

Equipment and operation . . . The Springfield station, located on the trunk line linking Texas, Oklahoma, and Kansas fields with Denver and other Rocky Mountain markets, was built in 1953.

It has four Cooper-Bessemer two-cycle reciprocating engine compressor units, totaling 5,400 hp., modified for automation.

Before the control system was in-

stalled, the dispatcher relayed instructions to station crews to adjust discharge pressures to meet pumping needs. Now, the dispatcher instructs the station set-point controller by means of a telemetered signal over a microwave channel. And the set-point controller does the station's thinking.

It selects the number of engines, starting or stopping them as required, and sets engine speed to deliver the proper discharge pressure. Springfield has all controls needed to maintain this pressure.

Operating changes such as pressures and the number of engines on line are visible on the control-center monitor, which checks all functions and conditions to assure safe operation. Changes are typed out on an electronically controlled typewriter.

The typewriter logs each normal start and stop as well as emergency shutdowns triggered by protective equipment, showing time and source of trouble. An alarm summons maintenance crews.

The digital telemetering and control equipment was engineered and designed by Southwestern Industrial Electronics Co., Houston, to CIG specifications. Engine start-and-stop sequencing equipment was designed by Stearns-Roger Manufacturing Co., Denver, and manufactured by SIE.

Kansas Shuts In 40 Sources of Derby Supply

• Production at Derby's reduced prices constitutes "economic waste," Kansas body says in granting producer requests. Involved is half of Derby's supply.

AN INTERESTING legal battle over crude prices is developing in Kansas that may have implications for other producing states.

The issue is power of a state agency to cut off a refiner's crude supply to prevent spread of a cut in posted crude prices.

The Kansas Corporation Commission last week ordered oil production halted in 40 Kansas fields in two counties where Derby Refining Co. is the sole purchaser.

Derby recently cut its posted prices in Kansas 20 cents a barrel from a top of $3.05 to $2.85. In its surprise ruling, the commission held that production of crude at this price would lead to economic waste and therefore should be halted.

About 8,000 bbl. daily is involved. The order is effective June 1.

Next move? . . . Derby strategy still has not been decided.

Company lawyers planned to study the ruling over the Memorial Day holiday. Some decision may be reached this week when President H. D. (Ike) Moore returns from a trip to the East.

Trade sources, however, say Derby will not be in immediate jeopardy by the shut-down order. It has comfortable crude storage. The shut-in crude represents less than half of Derby's current purchases of 17,500 bbl. daily.

There are reports also that Derby has been offered a long-term contract for 8,500 bbl. daily of Rocky Mountain crude at a price even lower than Derby's new Kansas posting.

It was the pressure of cheaper Rocky Mountain crude and low product prices in Kansas that prompted Derby to cut the price. Derby's refining operation reportedly lost heavily in the first 4 months of the year, averaging about 5 cents a barrel loss on throughput.

Kansas Allowable Cut

Kansas oil production allowable has been cut for the fourth month in a row.

The corporation commission pared June output to 293,000 bbl. daily—down 2,000 bbl. daily from May. The cut will be effected by holding production in prorated, restricted, and unprorated fields to a maximum of 25 bbl. daily.

Special-order deep wells were included in the restriction for the first time this year.

Producer case . . . The ruling provided a temporary victory for a committee of independent Kansas producers who had petitioned the commission to extend its jurisdiction over oil prices.

Headed by George H. Bruce, president of Aladdin Petroleum Corp., Wichita, the producers placed their case before the commission at its June production allowable hearing.

The producers argued that the cost of finding, developing, and producing crude oil in Kansas ranges from $2.85 to $3.50 per barrel.

They argued further that Derby's top posting of $2.85 for premium crude actually gives the company a chance to buy oil from 48 to 66 cents below prices posted by other buyers. The additional reduction, they said, is achieved by blending and applying gravity penalties.

The producers concluded that production below costs would constitute economic waste under its legal definition. They asked the commission to shut in production in the fields where Derby is the only purchaser. They also asked that the conservation director be appointed umpire with power to reopen production when the producers obtain relief from other companies or Derby.

Independents also made formal application for a commission investigation of rates charged by the Jayhawk pipeline in Southwest Kansas. It is jointly owned by Derby and National Cooperative Refinery Association.

The producers said distress prices and excessive rates on the pipeline "have combined to contribute very greatly to the desire and ability of Derby to take away the market for crude oil situated directly adjacent to their refinery."

The ruling . . . The commission in its shut-down ruling agreed that Derby prices are below producers' costs.

It held that this would impair and curtail exploration, development, and production of reserves, thus liquidating known resources without replacing them.

The commission added that pre-

INDUSTRY

The first tubingless triple completion in the Rocky Mountain area has been made at the Johnston-Shear 1-4 Jicarilla in Rio Arriba County, N. M. Producing zones are at 3,490, 5,980 and 6,930 ft.

Merger of Consolidated Gas Utilities Corp. into the Arkansas Louisiana Gas Co. has been approved by stockholders of both companies. The combined companies, operating as Arkansas Louisiana Gas Co., will serve 365,000 natural-gas customers in Oklahoma, Kansas, Arkansas, Texas, and Louisiana. The merger still must be approved by the Federal Power Commission and the Arkansas Public Service Commission.

Anaconda Lead & Silver Co., Denver, has purchased producing proper-

mature abandonment of wells would result, leaving recoverable crude in the ground, and secondary recovery would become impractical.

"Historically," the order stated, "the commission has exercised its jurisdiction and power to order a shut-in of wells and pools where the production and sale of crude oil would result in waste. The commission finds that the only way to avoid the commission of waste . . . is to order the producers of crude oil to cease producing and selling crude oil."

The following pools were affected:

Sedgwick County—Brumley, Chambers, Chambers-Northeast, Clearwater, Cross, Curry, Eastborough, Eastborough-North, Gehring, Rick, Gladys, Gladys - Southwest, Hohn, Wichita, Latta-North, Luening, Minneha, Petrie,, Robbins, and Schulte.

Sumner County — Bellman, Gerberding, Horsch, Kerley, Kerschen, Latta-Northwest, Zyba, Markely, McIlhenny, Moyer, Moyer - Northwest, O'Hara, Priddy, Zyba - Southwest Rusk, Seydell, Trekell, Wellington water flood, Wellington-East, Wusk, and Zyba-West.

The commission ordered the accrual of allowables so that lost production may be made up when the wells are reconnected.

Ultramar Buys Golden Eagle

GOLDEN Eagle Refining Co., acquired last week by Ultramar Co., Ltd., prominent British holding company, plans to jump the capacity of its Torrance, Calif., refinery from 9,000 to 30,000 bbl. daily.

Several million dollars of new financing have been advanced to Golden Eagle by its British parent to carry out expansion projects in both refining and marketing.

Golden Eagle is a leading Pacific Coast independent oil refiner and marketer. It acquired the Torrance refinery in 1958 from Sunset International Petroleum Corp. in a cash and stock deal. The company markets in six Pacific Coast states.

Ultramar is fourth in size among British oil companies and has worldwide operations including extensive production in Venezuela, Western Canada, and the northwestern U. S.

The consolidation of the two will result in an integrated oil operation. Plans have not been completed, but Ultramar expects to use its eastern Venezuelan production to meet part of the increased Torrance throughput.

Ultramar acquired Golden Eagle by purchasing the California firm's parent, Panamanian Refining & Petrochemical Corp., organized a few years ago by John M. Shaheen, president, and Eugene du Pont III, Wilmington, Del. The parent has plans to build a 55,000-bbl. refinery in Panama, also to be supplied by Venezuelan crude.

Ultramar recently announced in London that it had formed a Canadian company, known as the Golden Eagle Refining Co. of Canada, Ltd., which plans a new refinery at St. John's, Newfoundland.

Golden Eagle announced that the same personnel who have been directing its operations will hold identical jobs under Ultramar ownership.

Gas-Products Line

. . . proposed in Alberta by newly-formed company.

A NEWLY FORMED Canadian company, Provincial Products Pipelines, Ltd., is planning a $25,000,000 gathering system to pick up propane, butane and condensates from Alberta natural-gas plants.

The products are to be moved to refineries and other plants in Alberta. The surplus would go to export markets in the east and west by Interprovincial Pipe Line and Trans-Mountain Oil Pipe Line. Both of these crude lines would be interested in this additional business.

The $25,000,000 investment will provide for about 700 miles of line, ranging from 16 in. to 3½ in., and necessary other facilities.

An application to construct the system has been filed with the minister of mines and minerals and the Alberta Conservation Board.

A similar project in Alberta has been proposed by Westalta Products Pipeline, Ltd. Westalta estimates the cost of its proposed gathering system at $42,000,000. In addition, the company would construct a 1,300 mile 16-in. line to the Chicago area at a cost of about $110,000,000.

BRIEFS

ties of Rocket Petroleum Co., Lubbock, Tex., in a stock exchange agreement. The enlarged company will be known as First National Petroleum Corp. with headquarters in Albuquerque. Involved in the deal are 40 Rocket producing wells in Texas and 400 acres under lease in New Mexico. Howard P. Waite, Anaconda president, will be president of the new company. William J. Finch, chairman of Rocket, and Charles Schuler, president of Rocket, will be directors.

American Hydrocarbon Corp., Dallas, has bought 61 oil and gas wells and 15,000 acres of leases in Duval County, South Texas, from G. L. Rowsey et al. Purchase price was reported at more than $1,250,000. The producing wells are located in the Augua Prieta, Cadena, Cadena Yegua, Robinson, and Thomas Lockhart producing areas.

Landa Oil Co., Dallas, has been granted two concessions totaling 6,400,000 acres by the Australian government. William F. Lynch, Landa president, said both areas are in New South Wales and lie along the eastern rim of the Murray River basin. Landa has set up a subsidiary, Landa Australian Oil, Ltd., to explore the concessions.

Oil and gas revenues received by the Alberta Government since the 1947 Leduc discovery have now passed the $1-billion mark. The receipt of $11,606,400 from a recent sale of leases on 56 parcels in scattered areas of the province pushed the total over the billion-dollar figure.

Oil properties of Ramage Oil Co., Oil City, Pa., have been sold to Quaker State Oil Refining Corp. Included are 300 producing wells on 547 acres in Venango County, Pennsylvania.

Spencer Chemical Co. directors have approved an agreement to acquire all assets of Pittsburg & Midway Coal Mining Co. on the basis of 1 share of present Spencer common stock for 2.42 shares of Pittsburg & Midway. The plan already had been approved by Pittsburg & Midway directors and now will go before shareholders of both companies. Spencer plans to operate the mining company as a subsidiary. Pittsburg & Midway mines are located in Kentucky, Kansas, Missouri, Colorado, and Arkansas.

Plymouth Oil Co. will move its first operating headquarters from Sinton, Tex., to Houston this year. Sinton will become a regional office. General offices of Plymouth are in Pittsburgh.

Oil's Washington Offices Grow

• The activities and responsibilities of companies' Capitol representatives are increasing. The main jobs are furnishing information to the home office and official Washington, and the handling of growing regulatory matters.

Clyde La Motte
Washington Editor

OIL-COMPANY representation in Washington is gradually taking on a new look, and a new scope.

More and more companies have been opening Washington offices. Others, already there, have increased their staffs and functions during the past year or so.

This trend stems largely from the fact that oil companies are finding it increasingly difficult to do business without a listening post in the nation's capital. The oil import control program and federal regulation of natural-gas producers are only two of the obvious areas in which government action has a tremendous impact on the day-to-day business of an oil firm.

Oil isn't alone in discovering the effect of government action, or inaction, on business for the same thing applies to virtually all industries. But full-time oil company representatives are latecomers to the Capitol scene.

For a long time, the oil industry generally appeared to be content with the fire-fighting technique of rushing emergency squads to Washington when danger loomed. Gradually, however, this is being replaced with daily, on-the-scene representation.

The three basic aims of most oil company representatives in Washington are:

...To post the company on Washington developments.

...To furnish Congress, the Administration, and a large number of government agencies with information about the industry.

...To handle the increasing Washington workload virtually all oil companies face.

Although each company operates in a different way, it is clear most attention is given to keeping the home office posted on Washington trends and actions affecting the oil industry generally and the company particularly.

In some Washington oil offices, voluminous reports are sent almost daily to the home office. These may cover a wide variety of subjects, ranging from summaries of government press releases to highlights of testimony presented before some congressional committee.

In other offices, the emphasis is on spotting trends and forecasting the Washington political climate on issues involving oil. This role is one of interpretation and advice, rather than mere reporting.

> "I DOUBT if ever there was a time when it was more essential for business of every size and every segment to keep watch on the Potomac. For—like it or not—the attitude of giant government affects private business progress everywhere.
>
> "Government actually spends more of your corporate earnings than you do. It also takes from a minimum of 20% to a maximum top rate of 91% of your personal taxable income. It can t a n g l e your shop with red tape and curtail your program through harmful legislation.
>
> "So you are smart to keep tabs on Government."
>
> *—Frederick H. Mueller, Secretary of Commerce*

Regardless of the techniques used, the underlying purpose is to establish a better line of communication between Washington and the home office so decisions there can be made with an awareness of Washington developments which could affect those decisions.

Explaining oil . . . The next most important point of emphasis is supplying Washington with useful information about the industry and about the particular company.

For the most part, this isn't being done with a major public-relations approach such as the National Coal Policy Conference is using in its efforts to get a congressional committee established to study the nation's fuels picture.

Rather, almost without exception the oil company representatives in Washington use a "soft sell" technique, leaving all-out campaigns to the trade associations or other special industry groups.

Most Washington oil company representatives are extremely cautious about speaking out publicly on policy matters. And on those rare occasions when they do, it is only after they have checked carefully with the home office.

It would be a mistake, therefore, to consider the influx of oil company representatives in Washington as a major step toward providing the industry with a public "voice" in the capital.

But they do play an important role in improving Washington's understanding of the industry. Through their contacts with congressmen, regulatory agency officials, and many others in the jungle of bureaus in Washington, they are able to provide statistics, basic information, and other facts which help give the Government a clearer picture of the oil industry.

Information wanted . . . A newcomer to the Washington scene is often pleasantly surprised to discover that a congressman or an agency official frequently expresses appreciation for information about a pending bill or agency action.

One congressman explained it to an oil company representative this way:

"I don't have time to study closely all the bills that pour in. And even if I did, I still wouldn't understand all the problems well enough or have enough information on them to make an intelligent decision, unless someone provided me with some facts and an explanation. Personally, I like to know where I can turn to get such help when the occasion arises."

There are times, of course, when a congressman or regulatory official gets conflicting views from different company representatives on a given issue. For instance, the representative of a domestic oil producing firm might present different arguments on import controls than an international company with large holdings overseas.

However, it would appear logical that the industry would benefit more from having two views presented than in having none at all offered.

The grindstone job . . . The third, and perhaps least glamorous, of the principal objectives of oil company representation in Washington is to provide a working base for the increasing variety of things which a company must do in Washington.

A company frequently finds that it must turn to Washington to get a rul-

If you're opening a Washington office:

Do This:

● Choose your representative carefully. He should know your company well.

● Keep the lines of communication open. Obviously he cannot represent you properly unless he is aware of what the company is doing, and why. And it doesn't do any good for your Washington man to know what is going on in that city unless he is able to channel information to the right points in your company.

● Give him rank and authority commensurate with those with whom you expect him to deal. If the Washington representative is expected to deal with top Washington officials, he needs standing and authority in the company.

Don't Do This:

● Don't expect overnight results when you open a Washington office. Becoming useful in Washington is a slow, tedious process.

● Don't try to make too big a splash. Such a move is apt to backfire.

● Don't count on your representative to get special favors for your company. A little of this wears out a representative's welcome in a hurry.

● Don't measure the effectiveness of your Washington representation in precise dollars and cents. Your Washington man is dealing largely with intangibles, and they seldom show up in the cash register.

ing on a tax question; to acquire visas for personnel going overseas; to obtain a radio permit from the Federal Communications Commission or a certificate of necessity from the Federal Power Commission; to plead for an increased import quota before the Oil Import Appeals Board; or to testify before a congressional committee.

As a result, many companies find they are sending a constant stream of people to Washington for one purpose or another.

If the firm has representatives in Washington, this stream of in-and-out traffic can often be reduced, particularly if the Washington office has more than a one-man staff.

Also, companies have found that a Washington office can be extremely valuable in setting up appointments, directing them to key government people, and otherwise setting the stage for visits so that loss of time is kept at a minimum.

Too, there is the simple matter of having working space available for company officials visiting Washington. If, for example, company attorneys have to be in Washington for several weeks on a gas hearing at the FPC, they can have an office in which to work, frequently with secretaries to help them and with basic files available.

"Our company has found that the Washington office more than pays its own way by the savings it is able to make," one company representative says.

"Suppose we have a case before the FPC. Our company attorney can work here about as cheaply as he can at the home office. But if we hired a Washington law firm to represent us, it would cost us at least $250 a day, plus other expenses."

Some Washington oil offices include an attorney, or attorneys, which, in many instances, even eliminates the need for sending in the home office lawyer.

A bigger voice . . . As the Washington operations expand, it appears to be a definite trend to give the Washington representatives more authority and more responsibility.

Although some offices still serve primarily as relay centers, more and more are moving into decision-making categories. As a result, the rank given to Washington representatives is tending to increase. Several Washington staffs are now headed by an individual who is a vice president and who reports directly to the company's chief executive.

Many Washington representatives regularly appear before their company's board of directors to make suggestions and recommendations for company action, and to brief the board on the Washington situation.

"I find that the top officials in my company are turning to me more and more," a Washington representative comments. "I think this is happening because they realize more and more that just about everything the company does has to be considered in the light of what is, or isn't, happening in Washington. And since these men don't pretend to be experts in the government field, they depend on me for advice."

The worry that haunts him, as it does many another company man in Washington, is this: "I'd better be right, because there is so much at stake these days on what occurs in Washington."

Michigan Cuts Back Allowable for June

OIL and gas allowables in all pools on the Scipio-Pulaski-Albion trend in Michigan will be reduced on June 1.

Oil quotas will be cut from 150 to 125 bbl. per well per day. Gas allowables will be lowered from 200 to 165 M.c.f. daily.

Gerald Eddy, state oil supervisor for the conservation department, made the order upon recommendation of the Oil Advisory Board.

There were no explanations given for the move. It was learned, however, that Texas state officials recently contacted Michigan executives and advised that "other states should help take some of the burden" of cutting back crude supply to meet demand. Part of the rush of out-state companies into Michigan has been attributed to the 150-bbl. daily allowable.

Producers Favor Well-Spacing Factor

• Louisiana operators are united on one front: They want to cut drilling costs by increased well spacing, and they want a bonus oil allowable for these wells. Land and royalty owners provide opposition to the move.

LOUISIANA'S top oil producers are presenting a united front to the conservation department in behalf of a plan to add well spacing as a factor in fixing oil allowables.

They may differ on the details—but this one thing is certain: They want to cut drilling costs by increasing well spacing. And they want a bonus for wells drilled on larger acreage.

In a crowded hearing last week before Conservation Commissioner Ashton Mouton at Baton Rouge, the industry lined up strongly in basic support of two complementary plans proposed by Continental Oil Co. and the California Co.

Opposition was there, too. It came from spokesmen for landowners and royalty owners who fear wider spacing will leave some fields undeveloped. They also contended the proposed plan will benefit offshore producers to the detriment of those onshore.

The proposals . . . Continental laid out a plan that would permit the conservation department to increase maximum spacing for new pools from the present 40 acres to 80 acres and to increase the allowables per well proportionately.

If a well were drilled on 80-acre spacing, it would get a double allowable. If on 60 acres, it would get a 50% increase.

Conversely, if a well were drilled on less than 40 acres, its allowable would be reduced proportionately. However, the greatest reduction would be 50%—on 20-acre spacing. The department would determine spacing on each pool after public hearing.

The present basic method of computing the allowable—the depth factor—would be retained, except that the spacing factor would be added for new pools. Old pools would not be affected. The bonus for offshore wells also would not be changed.

The California Co. concurred in the Continental plan and supplemented it with a proposed method for establishing distances between wells spaced in excess of 40 acres.

Under Calco's formula the minimum distance between wells would be figured by 1,000 times the following: One plus the fraction formed by the number of acres minus 40, divided by 80. This would figure out, for example, to 1,000 ft. between wells of 40-plus acres, 1,250 ft. for 60 acres, and 1,500 ft. for 80 acres.

The formula for minimum distance from lease lines would be 400 times the following: One plus the fraction formed by the number of acres minus 40, divided by 80. This would be 400 ft. for 40-plus acres, 500 ft. for 60 acres, and 600 ft. for 80 acres.

Some companies proposed to the department that the maximum spacing for wells be raised to 120 acres, rather than just to 80 acres. One company, Atlantic Refining, wanted no ceiling at all. The present 40 acres, while a maximum, often figures to be much less than that because of the method for calculating the distance between wells or from lease lines. In some cases it's as low as 17 or 18 acres.

Virtually all the companies proposed that exceptions on wide spacing be granted for piercement-type structures and other completely faulted areas.

Texacò Inc. came up with a variation on the Continental plan by proposing that the allocation of allowables to wells on 40-plus acres be limited to 6% of the total market demand. This limitation would have to be reexamined periodically in the future as the number of new pools with 40-plus spacing increased and the number of old pools under lesser spacing dwindled in production.

The differences . . . While the industry was solidly behind the basic plan, there were several disagreements on how it should be applied.

For example, Texaco does not want to penalize new wells which are drilled on spacing of 20 to 40 acres. These wells would follow the present formula based on depth alone.

More serious, however, were the differences on the definition of old pools and new pools. At what point, the question arose, would the new acreage-factor formula begin operating?

Some companies favored granting the "new pool" designation to the development of new production in old pools—or, as it was put at the hearing, sands behind the casing. Others feared this would create more problems than it would solve, that it would put the conservation department in the position of granting different allowables for a multiple completion.

There were also differences on how many wells should be drilled before a new pool is considered an old pool. One suggestion was made that if an "old" pool has three wells which can be assigned more than 40 acres each, then it should get the proportionately higher allowable.

The opposition . . . Attorneys and representatives of landowners and royalty owners pleaded with Commissioner Mouton to delay a decision until they had a chance to prepare their case.

Only a smattering of opposition, or potential opposition, was present to combat the forces of the producing companies.

J. Huner, Jr., consulting geologist who represents 14 landowners, stated his general opposition to any increase in spacing above the present 40 acres but indicated a willingness to go along if the department requires "more precise data" that larger spacing will drain the area.

PIPELINE

A double-jointed contract for 78 miles of 30-in. for Trunkline Gas Co. has been awarded to Stanley-Bledsoe Corp., Tulsa. The pipe will be laid in Mississippi, Tennessee, and Louisiana. The contractor also is laying 3-in. and 4-in. lateral lines for Natural Gas Pipeline Co. of America, extending its gathering system in Jack and Wise counties, Texas.

Internal cleaning and coating contracts on Midwestern Gas Transmission Co.'s 500-mile 24-in. line from Emerson, Man., to Marshfield, Wis., have been awarded to Stanley-Bledsoe and Rosson-Richards Processing Co. Stanley-Bledsoe has 150 miles, headquartered at Gadsden, Ala., and Rosson-Richards has 52 miles, headquartered at Donaldson, Minn. Houston Contracting Co. will build two com-

It was Huner who took aim at offshore producers. He said there are many incompletely developed reservoirs offshore, and operators will take advantage of the larger spacing with multiple completions to obtain a larger proportion of the state's allowable production.

"If the industry is suffering from overproduction," Huner said, "then the burden of correcting such overproduction should fall equally on all of those interested in the oil industry throughout the state, and this should include offshore operations as well."

New Canadian Line

. . . to tap big natural-gas reserves in Northwest.

DEFINITE plans to build a $100,000,000 extension to the Westcoast Transmission Co., Ltd., system in British Columbia which would pick up vast new gas reserves, have been disclosed by Frank L. McMahon, president of the company.

A 250-mile 30-in. line will extend from Taylor, 30 miles north of Dawson Creek to Fort Nelson, near the British Columbia-Yukon border (OGJ, Aug. 10, 1959, p. 68). The line is to be built by a new company, Gas Trunk Line of British Columbia, Ltd., whose directors will be announced later.

Principal operating companies in the area will participate in the project, to be completed late next year, McMahon said. Capacity will be 650,000,000 cu. ft. daily.

LPG Storage Suit Nearing Trial

• Pretrial conferences in far-reaching patent suit will be held this week; trial is now scheduled for mid-July.

DOES STORING of LPG in a leached-out salt cavern infringe on a patent held by the late Sid Richardson?

First move in court toward a ruling on this significant question will take place this week in U. S. District Court in Amarillo.

Pretrial conferences have been scheduled Monday and Tuesday. Actual trial of the case—a patent infringement suit by Richardson interests against Pan American Petroleum Corp. and Skelly Oil Co.—is expected to get under way during the week of July 11.

The suit claims Pan Am and Skelly violated a 1957 patent in storing LPG in salt caverns in Hockley and Carson counties. Two other companies, Warren Petroleum Corp. and Mobil Oil Co., have been admitted as intervenors. Both have interests in the storage projects, along with 11 other companies. Phillips and Skelly are the operators.

Richardson's suit asks payment of one-eighth cent a gallon for all LPG withdrawn from the caverns since May 1957, when Richardson's patent was reissued. It also asks triple damages and an injunction against further withdrawals by the companies from the Hockley and Carson facilities.

In answering the suit, Pan Am and Skelly have contended that the methods of salt storage described are not patentable (OGJ, Aug. 3, 1959, p. 56).

The significance . . . Roughly 50 companies are engaged in salt storage of LPG. Most of them feel a direct interest in the pending suit.

If the Richardson patent should be upheld, they think it would be only a matter of time before each would be asked to pay the eighth-of-a-cent fee for withdrawing product.

The Richardson patent covers storage of any product in a cavern "formed by dissolving the salt with water and removing the so-formed brine."

Of the nation's 49,000,000 bbl. of underground-storage capacity, more than 80% is in salt formations. If half of this volume were withdrawn annually, total fees would exceed $1,000,000 a year.

Underground storage has grown tremendously in recent years (OGJ, Sept. 28, 1959, p. 75). Capacity has trebled since 1955, and additional capacity is still being added.

Companies have turned to salt storage because it is by far the cheapest method in areas where salt domes or beds are available. It is well below the cost of mined storage and still further below the cost of aboveground facilities.

BRIEFS . . .

pressor stations and 21 meter stations for Midwestern.

Two river-crossing contracts have been awarded to Pentzien, Inc., Omaha, Neb. Pentzien will install a single 20-in. crossing near Little Rock on the Arkansas River for Texas Eastern Transmission Corp., and a dual 18-in. crossing on the same river near Wright, Ark., for Arkansas Industrial Pipe Line Corp.

An 18-mile 10-in. gas line will be completed next month by Michigan Consolidated Gas Co. Welded Construction Co., Rosebush, Mich., is laying the line from Ludington to Manistee, Mich.

Work has started on the rerouting of 9 miles of 22-in. and 10-in. for Shell Pipe Line Corp. in Rogers County, Oklahoma. The existing route will be flooded by the proposed Oologah Reservoir. Houston Contracting Co. is handling the job.

Some 50,000,000 cu. ft. daily of natural gas from Brown-Bassett field, Terrell County, Texas, will start moving to California through the El Paso Natural Gas Co. system in December. The field, discovered in 1958 by Mobil Oil Co., is owned half by Mobil and half by Western Natural Gas Co. El Paso will complete a carbon-dioxide removal plant to process the gas late this year.

Oil-pipeline revenues increased 6.7% last year over 1958, although 18 of the 73 crude and products lines reporting to the Interstate Commerce Commission reported declines. Revenues were up from $666,920,000 to $711,721,733. Seven pipelines had declining revenues although volume of traffic was up 8% from 4,273,372,651 bbl. to 4,628,983,703 bbl.

Also for Pipeliners . . .

IN THE NEWS: Colorado Interstate has latest in push-button operation of gas lines with nation's "first remotely supervised automatic station" (p. 57) . . . Louisiana governor asking extension of gas-severance tax (p. 58) . . . Canadian gas exporters allowed more time to arrange financing (p. 70) . . . New 30-in. line moves Raudhatain oil south to Kuwait terminal (p. 74).

PLUS THESE TECHNICAL REPORTS: Tapline's experience with gas turbines (p. 77) . . . Pipeline construction report (p. 111) . . . Natural-gas-storage capacity jumps 12%, Journal survey shows (p. 89).

Gulf's Guzzo warns: Choose now between a quality or a marginal business

MARKETING MANAGERS must decide now whether they want to keep the profits in the oil business.

Most won't last long enough as managers to see supply and demand again reach a natural balance—so a marketing policy decision now is paramount.

With these stern warnings, Charles J. Guzzo of Gulf Oil Corp., vice president of the API marketing division, told the spring convention of marketers in Cleveland to choose now between a quality or a marginal business.

"Our distressing decline, it seems to me, stems in part from not setting and holding to consistent policies," Guzzo said. "We've tried to be all things to all men with the usual sorry results."

"Are we merchandisers of superior products, services, and locations, at prices that return a fair profit?

"Or are we marginal operators content with minimum return on large volume of questionable product turned over with minimum or no service?

"We cannot sell both ways at once, or we'll end up flat on our backs like the circus clown trying to straddle two horses."

Courage . . . Guzzo's advice: Take a stand on one side of the street or another.

"If you believe yours is a quality business, anchor your actions to that principle," he said, "and refuse to be budged by fear, doubt, or what the other fellow's doing.

"Build up your stations as outlets for superior products and services that provide ever-increasing values to your customers. But have the courage to insist on merchandising your goods and services at a profit.

"Somehow a good many marketers today have clean lost sight of profit and substituted what I can only call a mutton-headed devotion to volume. Nothing could be more destructive to marketing progress," he said.

The marketer who sticks to quality must have courage, Guzzo warned. No one can have the whole market on such terms, and the quality operator will risk the loss of an indeterminate volume for an indeterminate time. He will have to break with the custom of imitating every competitor which has plagued the industry.

Guzzo declared no great retail industry functions on a lowest-common-denominator basis only and the merchant who sells on price alone gets only the crumbs of the trade.

Emphasis on quality . . . The quality operations still thrive in other lines of business, Guzzo said.

He pointed to the great department stores which have withstood discount houses. Quality hotels are jammed despite plentiful poor accommodations in all cities. Quality dress shops flourish despite bargain basements.

Guzzo warned that if these quality operators had tried to compete on a basis that would attract customers from the cut-rate operators, the quality houses would very soon go broke.

"Isn't that just the road down which our industry has been traveling?" Guzzo asked. "Obviously if we try to compete with marginal stations on their terms, we must sink ever closer to their level. One by one we will surrender our assets, which will become eventually too costly to afford, until we are indistinguishable from them."

Guzzo said good oil marketers still will be able to fashion a superior product, up-to-date plant and equipment, convenient locations, and good service into tools that determine the motorists' buying habits.

"The concept of quality merchandising stands or falls on our professional ability," he told the assembled marketers.

Dealer a key man . . . One of the most important assets for winning the battle for public favor in days ahead lies in expanding the education of dealers, Guzzo declared.

Such training will increase margin of value customers receive at service stations. It will advance the interest of oil companies by helping dealers know reasons for company policies and be proud to represent them and impart them to the motorist.

Along with dealer training, it also is important that marketers strive for high ethical standards among dealers

PROCESSING BRIEFS . . .

A 19,000-bbl. catalytic cracking unit at the closed American Oil Co. refinery at Destrehan, La., has been bought by the Houston division of Signal Oil & Gas Co. and will be moved to Houston. It will bring fluid cat cracking capacity at Signal's 65,000-bbl. Houston refinery to 39,000 bbl. daily.

Oronite Chemical Co. is doubling its capacity for polybutene at Richmond, Calif. The Standard Oil Co. of California subsidiary will spend $3.4 million to expand two existing plants and build a third one. New capacity will be on stream next year. The butylene polymer is enjoying a fast-growing market in lube additives, caulking compounds, electrical insulation, adhesives, and rubber. Oronite's output will be handled by its recently organized Industrial Chemicals sales division, along with detergent bases, dispersants, xylenes, gas odorants and other petrochemicals.

Ethyl Corp. of Canada has awarded Canadian Badger Co., Ltd., contract to build an ethyl chloride-ethylene dichloride plant at Corunna, Ont.

A contract covering the engineering and construction of a 3,500-bbl. naphtha hydrodesulfurization unit has been

Also for Refiners . . .

IN THE NEWS: Kansas Corporation Commission orders fields shut down where Derby Refining is lone buyer, charges economic waste results from lower posted prices (p. 60) . . . British holding company buys Golden Eagle, a West Coast refiner and marketer (p. 61) . . . Richardson suit over LPG-storage process comes up for pretrial hearing (p. 65) . . . API marketing chief tells executives they must choose between quality or marginal operations (p. 66) . . . Oil industry launches drive to step up demand for gasoline, fuel oil, and lubes (p. 67) . . . Consultant says design your plant to run dirty—it's cheaper (p. 70) . . . Cuba pressuring refiners to run Russian oil (p. 71).

PLUS THESE TECHNICAL REPORTS: How refiners battle gas-turbine problems (p. 87) . . . How refiners solve some asphalt problems (p. 97).

Charles J. Guzzo
"Take a stand on one side of the street or the other."

and all marketers. "The survival of quality merchandising depends on our honestly inspiring and deserving public confidence," he said.

A rebirth of marketing is not an impractical dream despite the present unrealistic scramble for all the business at marginal returns.

"In our free society, each of us must answer that question as individuals. But if enough of us have the courage to get out of knee pants and into the grown-up clothes of seasoned businessmen, we can quit knuckling under."

Guzzo added: "It is up to each one of us, not somebody else, to stand firm in the face of crisis, and lay the foundation for a more prosperous petroleum market."

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awarded to Fluor Corp. of Canada by British American Oil Co. Construction of the unit, at British American's Calgary refinery, is to begin in August and be completed in September.

Southwest Research Institute reports that recent tests conducted for Southern Pacific Railroad indicate that the use of LPG as a fuel for EMD locomotive engines with a dual injection system is entirely feasible and is almost 50% cheaper than diesel fuel.

Tetramethyl lead will be blended into all premium gasoline marketed by Chevron Oil Co. stations in Chevron's 13-state East Coast marketing area. Chevron, a Standard Oil Co. of California marketing subsidiary, will be the first eastern company to market methyl gasolines on a wide scale.

Marketers plan multifront sales pitch

MARKETING MEN last week made small beginnings on a three-front sales drive aimed at increasing national demand for gasoline, fuel oil, and lubricants.

In the wake of the annual mid-year convention in Cleveland of the API division of marketing, there were these developments on:

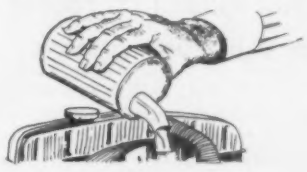
Gasoline demand . . .

James Bennett, new director of the API committee to stimulate gasoline demand, returned to New York and immediately began working on a crash promotion program.

Bennett was given authority at the Cleveland gathering for a program designed to convince the public there's still fun in motoring (OGJ, May 23, p. 64).

He will aim articles for all print media and tie-ins for radio and television broadcasts. The strategy is to restore the popularity of motoring and get for the oil industry a bigger share of the leisure market.

Further plans for an industry-wide advertising campaign to back up the promotion program will be made July 12-13 in Chicago at a meeting of oil advertising executives. Possibilities will be discussed then of testing selected markets preliminary to a national advertising campaign.



Lube-oil demand . . .

A committee of marketing men has scheduled a session with executives of Ford Motor Co. to talk over Ford's lube-drain recommendations.

Ford recommends an oil change only every 4,000 miles. The Cleveland convention reaffirmed the API standard of an oil change every 30 days in winter, 60 days in summer or every 2,000 miles. Engineers pointed out that chemicals in lube additives corrode the engine if longer intervals are followed.

Individual company marketers agreed at the sessions to promote the API-recommended change. Companies having liaison representatives in Detroit were asked to have these men also confer with their counterparts in the auto industry in an all-out drive to get the car makers to shorten their recommended oil-change intervals.

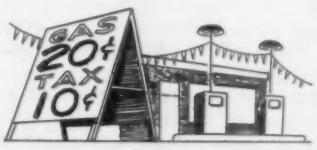
The API is continuing a $75,000 information and marketing program for lube-oil demand.

Fuel-oil demand . . .

The general marketing committee voted to ask the API directors for a $500,000 research program to improve efficiency of oil burners.

The research committee declared such a program for improving oil burners, installations, and product efficiency was important to the oil industry. Battelle Memorial Institute has suggested 16 separate research projects costing about $500,000 covering burner problems not being studied by oil company scientists.

J. G. Jordan, Shell Oil Co. marketing executive, told the committee the research work could extend over a number of years with projects planned on a year-to-year basis.



Expose the tax picture . . .

The marketing committee approved in general the idea of letting motorists know how much gasoline taxes they pay.

It was agreed that the price of gasoline and the tax should be stated separately. Members praised the state-wide campaign of dealers in Virginia who won large amounts of publicity on a similar campaign.

Oil Problems Make Headlines as . . .

FPC probe showed one thing: It's bogged down

THE CONGRESSIONAL probe into the practices at the Federal Power Commission ended last week, at least for the time being.

Rep. Oren Harris, chairman of the House legislative oversight subcommittee, said the subcommittee had to turn to a study of pending legislation and could give no further time to the probe now.

Not much was developed during the course of the hearing. It was brought out that many company representatives have called on commissioners and staff people at various times, but the commissioners testified that there was nothing wrong with this since merits of individual cases weren't discussed.

Officials of Tennessee Gas Transmission Co. and its affiliate, Midwestern Gas Transmission, argued that a company has a right to argue merits of the case as long as FPC staff members are permitted to discuss the merits with commissioners after the record of a case has been closed.

Several members of the subcommittee indicated that they would favor legislation specifically prohibiting such ex parte contacts, by a company or by a staff member involved in the case.

It appeared unlikely to observers that any serious repercussions would result from the hearings.

Some members of the subcommittee were critical of contacts made with the commission by Thomas G. Corcoran, an attorney representing Tennessee and Midwestern, just before the commission ruled on Midwestern's certificate application.

But they apparently accepted the testimony of the commissioners that these contacts had no bearing on the commission's action.

One fact that was clearly established: The FPC is almost hopelessly bogged down in its effort to regulate the natural-gas industry.

Several suggestions for improving the situation were made, including three proposals offered last week by Gardiner Symonds, top official of Tennessee and Midwestern, as the hearing neared an end.

Symonds suggested—in response to a question—that the greatest need is to eliminate public-utility control of producers. He said efforts to apply cost of service principles to producers are not feasible and that efforts to do so only create added delay in FPC handling of cases.

He suggested, further, that action be taken to reduce the number of intervenors in pipeline cases.

And Symonds also urged that ex parte contacts with the Commission by staff members be ruled out. Otherwise, he said, a company should continue to have the same right.

Thomas G. Corcoran
. . . some congressmen were critical.

Gulf loses first round in suit over quotas

GULF OIL CORP.'S challenge of Interior Department's method of allocating residual-fuel import quotas apparently is headed for the Supreme Court.

Both Gulf and the Government want the high court's decision on the case because it involves key issues in the administration of the import-control program.

The Government won the first round when a U. S. District Court judge last week granted the Government's petition for summary judgment. Gulf immediately announced that it plans to appeal.

Gulf wants residual quotas tied to domestic residual sales, as crude import quotas are tied to domestic refinery runs. In its argument before the court it maintained that the present system of basing residual quotas on residual imports in 1956 is unfair to Gulf and to others and that it permits three companies to import 58% of total residual imports in Districts 1-4.

"If this were an antitrust case, government lawyers would be jumping with glee over the 58% 'monopoly'," Gulf attorneys told the court.

They insisted that Interior had misinterpreted the President's proclamation concerning residual-fuel imports and that the resulting regulations were unfair and unreasonable.

The judge, however, ruled that the regulations are valid and that they do meet the requirements of the President's proclamation.

Furthermore, he said, the basis for allocation used by Interior is neither unfair nor unreasonable.

Coal executives ask cut in imports of residual

THE COAL INDUSTRY sent its top brass to call on Interior Secretary Fred Seaton last week in an effort to get residual-fuel imports reduced.

Their timing was important because Interior currently is mapping residual-fuel quotas for the next 3-month period, beginning July 1. Announcement of the quotas is expected within a few days.

Target of the coal group: Restriction of residual imports to the 1957 import level.

(This would be a marked reduction because 1957 imports averaged 343,445 bbl. daily in Districts 1-4 whereas current resid imports are 490,930 bbl. daily.)

The coal delegation told Seaton that the current domestic market demand for residual fuel has been "inflated" by the "dumping" of imported resid on the U. S. market at below-cost prices.

The group argued that if residual fuel were sold only at "normal" prices, the demand would not be increasing.

Coal officials also raised the question of custodial stocks (stocks held by one company for another) with the

implication that in this manner a company might be able to make its stocks appear to be lower than they actually are.

Seaton said the Bureau of Mines had felt that custodial stocks were not of sufficient size to be important, but he said that he would have the matter looked into.

The 12-man coal delegation included George H. Love, chairman of the National Coal Policy Conference; Joseph Moody, president of the conference; Stephen F. Dunn, president of the National Coal Association; Julian D. Conover, executive vice president of the American Mining Congress; John L. Lewis, former president of the United Mine Workers; and several other coal and railroad officials.

Restrictions on imports from Canada dropped

INTERIOR Department has dropped a proposed rule affecting the importation of crude oil from Canada.

The plan would have required refiners to deduct Canadian imports made from September 1958 to March 1959 when computing their minimum import quotas.

In proposing the rule, Interior asked for industry comments. Last week, after studying these comments, it decided to drop the proposal and continue the present method.

The reason Interior gave for dropping the rule was that its effect would have been to cut the import quotas of Upper Midwest refiners.

Solons back producers in plea for imports cut

A GROUP of congressmen went to Interior Department last week to support the plea of domestic producers for a reduction in crude-oil imports.

Rep. Frank Ikard (D.-Tex.) headed the delegation of four Democrats and four Republicans from oil-producing states.

The group, which talked to Interior Under Secretary Elmer Bennett, said it wanted the administration to know first-hand the condition of the oil industry in each area.

Their reports included the following highlights:

... **In Texas** the number of producing days for the first 5 months of this year was down nearly 20% from the same period of last year.

... **In Oklahoma** the number of wells drilled to date is 35% below the

watching WASHINGTON

Clyde La Motte

• Post mortem of a congressional probe . . .

THE FEDERAL POWER Commission will wrap itself more tightly with red tape and legalistic procedures now. The reason: To protect itself from criticism.

That will be the chief result of the probe of the FPC by the House Legislative Oversight subcommittee.

There may be an effort by Congress, itself, to put the FPC into a vacuum to protect it from any possible contamination. But that will not be really necessary, for the FPC will move in that direction on its own.

It will become more skittish in any dealings it has with the industry or even with its own staff. It will lean over backward to prove that it isn't the captive of the industry. It will dwell on legal technicalities while its backlog of cases piles higher and higher.

It would be hard to blame the commissioners too much if this should happen. After all, they have been raked over the coals in a public hearing, even though there was no evidence of wrong doing on anyone's part.

Furthermore, the tempo of the times—especially in Washington—seems to be to avoid criticism at all costs.

Note that President Eisenhower, himself, evidently sought to steer a "safe" course in his two recent appointments to the commission by picking two men who know nothing whatsoever about the gas industry.

And the investigating subcommittee seemed much more alarmed over the fact that there is no law prohibiting an industry representative from talking about a case with a commissioner than it was over the years-long delay many companies face in rate cases and certificate applications.

• Some questions that weren't answered . . .

ADDITIONAL notes on the congressional probe of the FPC:

It apparently didn't occur to any subcommittee member to wonder why, if Midwestern Gas Transmission Co. does have "influence" at the FPC, it took the company 4 years to get the job done. That would appear to be a pretty low grade of influence.

Considerable comment was made during the hearing about the fees some pipeline companies have paid to their attorneys in gas cases. But no one raised the point that if it didn't take so long to get a case settled at the FPC, the companies wouldn't find it necessary to pay such fees.

Some congressmen were sharply critical of the fact that a company is permitted to file a second rate increase before the commission has ruled on the first rate hike application. And they seemed to blame company "greed" rather than FPC inaction for this state of affairs.

• Some ammunition for a gas bill fight . . .

THERE WAS considerable quiet talk in the corridors about whether the congressional investigation of the FPC would have an effect on the chances for passage of a natural gas bill in the foreseeable future.

Short range, some harm may have been done. When a gas bill does come up, it is only natural to expect that the public will be reminded that the industry was involved in an "influence" probe.

Long range, some good may come from the investigation. After all, it was made pitifully clear during the hearing that the FPC is fighting a hopeless, losing battle under the present regulations. This should help make congressmen and others aware that even the gas consumer is being penalized by procedures now being followed, and that the eventual answer has to be a change in natural-gas legislation.

same period of a year ago. Wildcat drilling is down 22%.

... **In Kansas** production allowables have dropped 10% since February and prices have been cut by as much as 20 cents a barrel.

... **In California** crude prices have dropped as much as $1 a barrel during the past year, and drilling is off 15% from last year.

... **In New Mexico** and Wyoming exploratory activity showed a "serious" decline in the first quarter.

The visit to Interior by the congressmen followed two earlier moves by producer groups to get the level of crude imports reduced. The Independent Petroleum Association of America wrote to President Eisenhower urging that a study of the problem be made, and representatives of a number of other producer associations presented their arguments to Bennett.

Thus far, there has been no indication that the administration is considering any substantial changes.

Senate is in no hurry to confirm FPC members

ACTION is still dragging on the two presidential appointments to the Federal Power Commission.

The appointees, Thomas J. Donegan and Paul A. Sweeney, appeared briefly before the Senate interstate and foreign commerce committee last week, but the hearing amounted to nothing more than giving the two men an opportunity to submit their biographical sketches.

Questioning was delayed until a later meeting, with no date set. Some committee members said they would have "quite a few" questions.

One reason given by the committee for the delay is that a hearing is to be held by a House committee this week on a Senate-passed bill which would permit a member of a commission to continue to serve until his successor has been appointed and confirmed by the Senate.

Should this bill be passed, it would enable William R. Connole to continue on the commission until action has been taken on his successor. Thus, if the Senate failed to confirm Donegan or someone else as his successor before congress adjourns, Connole would continue in office.

Whether the legislation passes or not, Washington observers are of the opinion that the senate is in no hurry to act on the appointments, because if no action is taken before adjournment permanent appointments could not be made until next year when a new president will be in office.

Run a dirty plant—it's cheaper

A NEW approach to design of thermal process plants—build them to run 7 to 10 years without turnarounds—was given last week to delegates attending the computer conference of Western Petroleum Refiners Association at Houston.

Donald Q. Kern, who heads his own consulting firm, startled the refiners by telling them it would be cheaper in the long run to design a plant to run dirty.

The main reasons for turnarounds, he said, are to clean fouled heat-transfer equipment. Heat transfer declines with time because dirt is always being deposited faster than removed by the increased fluid velocity.

But maintenance wears out equipment and is expensive both in labor and lost down-time. For these reasons, Dr. Kern would design a plant to run dirty for any number of years and still be economical.

This would require the thermal equipment to be designed for continuously changing heat-transfer coefficient, for fouling, throughput-pressure drop, velocity, etc. Kern explained that all the terms should be made variable and solved for the optimum.

The heavy-chemical industry already has switched to this new design method, he said, but the petroleum industry has shied away. His explanation: Petroleum refiners are too tied up in their specifications to change. The present specifications should be discarded because they cost money.

Kern also observed that refining operations are beginning to be unprofitable partly because management wants too short a payout time on process equipment.

He said when a plant is being paid out rapidly, depreciation charges are so high it becomes uneconomic on paper to run when high utility and maintenance costs are considered.

The short payout time also is one factor behind fast process obsolescence. A refiner is more likely to replace a unit that is paid out.

Computers haven't all the answers

A MAN in charge of a process computer group for a major oil company recently asked to change jobs.

Why would anyone want to change when computers are so highly regarded?

Here are some of his reasons:

... **Specialty** in computers sidetracks one for management jobs. There is a lack of communications between computer groups and management.

... **Accounting departments** monopolize much machine time and make it difficult to schedule process calculations.

... **It is difficult** to get a good computer group without getting into management-type decisions.

... **Much of management** is suspicious of computers and how computers can make better decisions than they. A breakthrough is needed in management understanding of computers.

The case was cited by Dr. Donald Q. Kern, of Donald Kern Associates, at the computer conference of the Western Petroleum Refiners Association last week in Houston.

More Time Granted Two Alberta Companies To Complete Financing

TWO CANADIAN companies which were recently granted permits to export Alberta natural gas have been given additional time to complete their financial arrangements.

The firms are Alberta & Southern Gas Co., Ltd., and Westcoast Transmission Co., Ltd. (OGJ, Apr. 11, p. 83).

Originally Alberta's Oil and Gas Conservation Board had called for financing arrangements to be completed by June 1. An extension to September 1 was granted.

Alberta & Southern, which will move gas to the California market, asked for the additional time because neither the Federal Power Commission nor the California Public Utilities Commission has approved the company's plans.

Westcoast, which will use the same facilities as Alberta & Southern to move gas to the U. S. Pacific Northwest, requested the extension so it can align its financing with Alberta & Southern.

Soviet Oil for Cuban Refineries?

● **Castro tells three operating companies Soviet oil is "available" for feed stock. Rumors are that each will be expected to process 10,000 bbl. daily of imported Russian crude, or about half of Cuba's daily consumption.**

FIDEL CASTRO'S revolutionary government in Cuba has finally gotten around to the oil industry's biggest stake in the Caribbean island.

In the 18 months since Cuba's bearded mountaineer rebel paraded into Havana after Dictator Fulgencio Batista fled the country, his leftist government has helped itself to American-owned cattle and sugar lands and other properties.

In a pretty empty, flamboyant move 6 months ago the government sealed the office files of all oil companies doing exploratory work and producing on the island. The move puzzled most companies and at the same time gave them a quick answer to a problem.

It puzzled them because the government already had copies of most of the exploratory records. It gave most of them a quick answer to the problem of whether or not to waste any more exploratory money in Cuba. A dozen companies have sunk millions in seismic work and deep dry holes in Cuba over the past 5 years with nothing to show for the investment. Cuba produces less than 600 bbl. daily from marginal wells.

But last week Castro moved on the only profitable oil-industry operation on the island, refining and marketing. Under the Castro regime even these haven't been too profitable.

In a backhanded move that was short of nationalization, but carried the implied threat of just such action, the Castro regime notified Royal Dutch-Shell, Texaco, and Esso that Russian crude oil would be "available" for the three companies to refine in their Cuban refineries.

All three need Soviet crude like they need a hole in the head. None of the big three is inclined to refuse to process the cheap Russian crude which is just beginning to reach Cuba because of the unspoken threat of nationalization if they should refuse.

What's involved . . . At stake is a basic capital investment of from 50 to 60 million dollars in three modern refineries on the island. In addition all three have extensive marketing organizations and retail outlets in Cuba.

None of the three companies would make any official comment on the Cuban action, but the industry rumor was that Castro's government wants each of the three to process 10,000 bbl. daily of imported Russian crude.

This would amount to almost half of Cuba's daily consumption which lies somewhere between 60,000 and 65,000 bbl. daily. Crude oil for the three refineries, with a total throughput of 84,000 bbl. daily, has come from producing affiliates of all three in Venezuela.

Even before last week's move, doing business in Castro's Cuba has been difficult with the three refiners supplying their own crude from Venezuela. Cuba now owes the three at least $60 million in exchange balances due for crude imported since Castro took over. His economically shaky administration cannot supply the dollars to pay for the Venezuelan crude.

The situation is presumably at least one reason why the Castro government has dealt with the Russians for oil supplies.

Even with the Soviets supplying all of Cuba's crude needs, the country's small refineries which were quickly taken over by the Castro regime couldn't begin to satisfy the island's product need. The Cubans are now operating three small "potboilers" on the island, the biggest with a 2,500-

TEXACO'S REFINERY at Santiago de Cuba is one of three major-company refineries affected by Castro "invitation" to process Russian oil.

Crude too salty, Petrobras tells Russians

BRAZIL has rejected oil offered by Russia in exchange for Brazilian goods under a barter agreement signed by the two countries last December.

Petrobras, the official Brazilian oil company, turned down oil samples supplied by the Soviets as too salty.

Under the terms of the trade agreement signed in Moscow, Brazil was to get 4,000,000 bbl. of Russian oil over the 3-year period of the pact (about 3,650 bbl. daily). Brazilian circles last week speculated that Russian wheat and farm machinery will probably be substituted for the rejected oil. The Russians are specifying the best grades of Brazilian coffee in their part of the trade.

Foreign trade observers recalled last week that Egypt had to re-refine Russian kerosine and diesel oils shipped to Cairo in 1955 under a similar trade agreement under which the Russians got long-staple Egyptian cotton.

bbl. daily capacity and with a total throughput for the three of only 3,400 bbl. daily.

Shell's refinery at Belot, near Havana, can process 27,000 bbl. daily and the Esso Standard plant at Belot has a design capacity of 36,500 bbl. daily since it was rebuilt several years ago. Esso is now running only at about 50% capacity.

Texaco's modernized refinery at Santiago, on the opposite end of the island, can process 20,000 bbl. daily.

Marketing affected too . . . In a corollary move, Cuba's Minister of Commerce Raul Cepero Bonilla, issued a decree last week canceling all exclusive marketing contracts the companies had with retail gasoline outlets.

This move would open the possibility that Soviet products shipped to Cuba might try and fulfill local demand over and above the 30,000 bbl. daily of crude for the privately owned refineries. Several Soviet tankers have moved into Havana during recent weeks, but the exact amount of either crude or products shipped is not known. The first two tankers which unloaded hauled products, not crude.

Under a commercial trade treaty signed last February, Russia agreed to furnish the Cubans crude, gasoline, and other petroleum products. Prices the Cubans are paying for the Soviet shipments have never been revealed, but they are generally believed to be below world prices.

New Indian Well Is Best Yet

• The find in the Cambay area may change the country's refining plans. Six more wells set for this year.

THE INDIAN government is so excited about its latest oil discovery, it is already talking about a refinery to process the crude.

The newest find in the Cambay region of western India has only added to the government's enthusiasm for that area. Just a few days before K. D. Malaviya, India's socialistic-minded minister for oil, revealed the new find, the government asked the state government of Gujarat to postpone plans for building a new capital because the site is in a prospective oil region.

Malaviya told the Indian parliament last week that the new discovery was made with a Russian rig near the village of Hajat in the Ankles War region of the Broach district. The area is about 100 miles to the south of Cambay town which has been the center of previous drilling. The new find is about 140 miles north of Bombay and on the eastern side of the Bay of Cambay.

The minister warned his parliament listeners to take the news with "cautious optimism." He added that preliminary reports from the well indicate it is the best yet found in the 3-year-old government oil-finding effort. The first discovery was drilled 2 years ago in the Cambay area and found three oil-bearing zones.

The new well was spudded the last week of February and struck the producing pay within 60 days, according to Malaviya, at a depth of about 1,200 meters (3,936 ft.).

"Oil has gushed out the second day of our testing operations," he told parliament. "More detailed information is awaited, but it seems that this Ankles War oil discovery is the best we have made so far in the Publi sector."

He added that preliminary reports indicate the well was testing at a better rate than previous finds in the Cambay region to the north and that the crude was of better quality. The Indian government has never released test figures on any of the five successful wells that have been drilled in widely separated locations in the Cambay area.

Future plans . . . Malaviya said last week that drilling conditions were easier in Ankles War than in Cambay and he hoped that another five or six wells could be drilled in the area of the new discovery by the end of the year. Two American-built rigs are already being shipped into the area to join the Russian equipment at work there.

The Indian government had already been discussing building a small refinery at some location in the Cambay region as a "pilot plant" operation to process crude from the Lunej discovery and others. The new discovery brought questions from parliament about an exact site for the new plant. Malaviya said the new well might mean a change. He suggested that Baroda, about midway between the new productive areas, might be the site chosen.

At about the same time the new find was revealed, the Indian Oil and Natural Gas Commission asked the government of Gujarat to postpone "for a few months" its plans for a new capital near Ahmedabad, north of Cambay. The commission told the state government it wants to drill a wildcat on the proposed capital site. The commission expressed the idea that the state government would be happy to choose another site if oil should be found on the one it has now picked.

At the end of last week, Malaviya was off to the little village of Hajat for a personal look at the newest oil find. Presumably he wants more detailed information on the new well than the first reports from the remote area.

Ohio, Amerada, Continental Form New Libyan Company

- The firm will handle the exploration, production, and transportation for the combine. Big exploration successes made the creation of the management company advisable.

T. A. van Griethuysen
. . . to head Oasis Oil Co.

R. E. McMillen
. . . new executive vice president.

Ralph Williams
. . . in charge of New York office.

FLUSH with exploratory success, a three-company combine which holds more acreage in Libya than any other group is changing its corporate setup to produce and move the oil it has found.

Ohio Oil Co., Amerada Petroleum Corp., and Continental Oil Co. have formed a new Libyan-based company to handle the group's operations in the North African hot spot.

The new company will be Oasis Oil Co. of Libya, Inc. It will conduct future exploration, development, and transportation operations for the three parent companies.

The new firm will not engage in refining or marketing operations. This indicates that the three parents intend to go their separate ways from some Mediterranean loading terminal. Last week the three had not yet reached a decision on future plans for a pipeline and loading terminal on the Mediterranean. Officials of all three companies have indicated privately in the past they are weighing the possibility of joining with Esso Libya in a common-carrier type of pipeline.

The new company is taking the name of the wholly owned subsidiary of Ohio Oil which up to now has acted as the operator for all three in Libyan exploration. The old Oasis Oil will now become Ohio Oil International of Libya, Inc.

The real new look involved in the new Oasis Oil will be in its personnel. The old company was staffed entirely with Ohio Oil people. The new company will draw its personnel from all three parents.

Top officers . . . The new president will be T. A. van Griethuysen, former president of Continental Oil Co. of Venezuela, who earlier this month stepped down as president of Paria Operations, Inc., which is operating in the Gulf of Paria separating Trinidad and Venezuela. Continental and Ohio each have a 25% interest in Paria Operations.

Executive vice president of the new Libyan company will be R. E. McMillen, current resident manager of the original Oasis Oil, and a long-time Ohio Oil exploration man.

Ralph Williams, former assistant manager of the California division of Amerada, will be vice president in charge of the new Oasis' New York office.

The three parent companies said last week that provisions for this kind of a corporate setup were made when they first became associated in Libya and came about at this time due to the need for a larger and more specialized management group located in Libya because of the previously successful exploration.

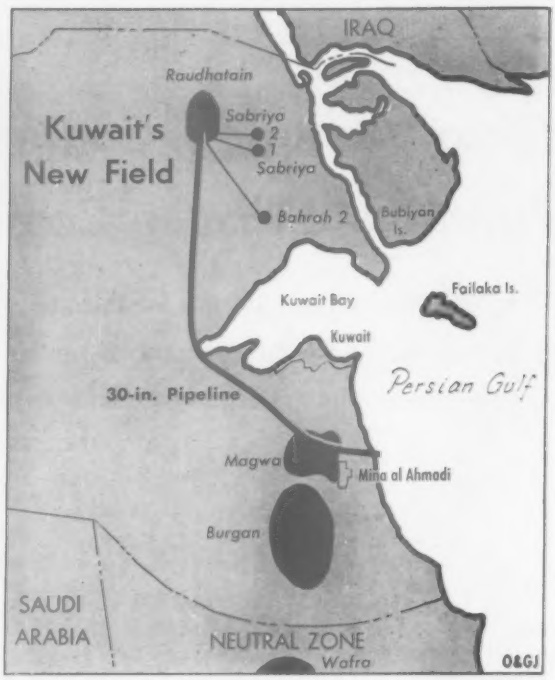
Ohio Oil International of Libya will retain its present officers and will continue to hold title to the parent company's one-third interest in the 62,000,000 acres of Libyan concessions. The Amerada and Continental interests are held by Amerada Petroleum Corp. of Libya and Continental Oil Co. of Libya.

Dozen rigs active . . . The three companies have been jointly associated in Libya since 1956 when the original concession grants were made by the Libyan Government. They have 12 rigs now active out of the total of 32 operating in the country. Last year Oasis drilled 10 of the 39 wells drilled by all operators in the country and 6 of the 18 oil or gas producers completed in Libya last year.

To date the three-company combine has found one-well wildcat fields in two widely separated areas and what appears to be an extensive field at Dahra where three gas wells and six oil producers have already been drilled on fairly widely separated locations. Mobil Oil has completed a producer offsetting Dahra to the south, indicating a further extension to the pool.

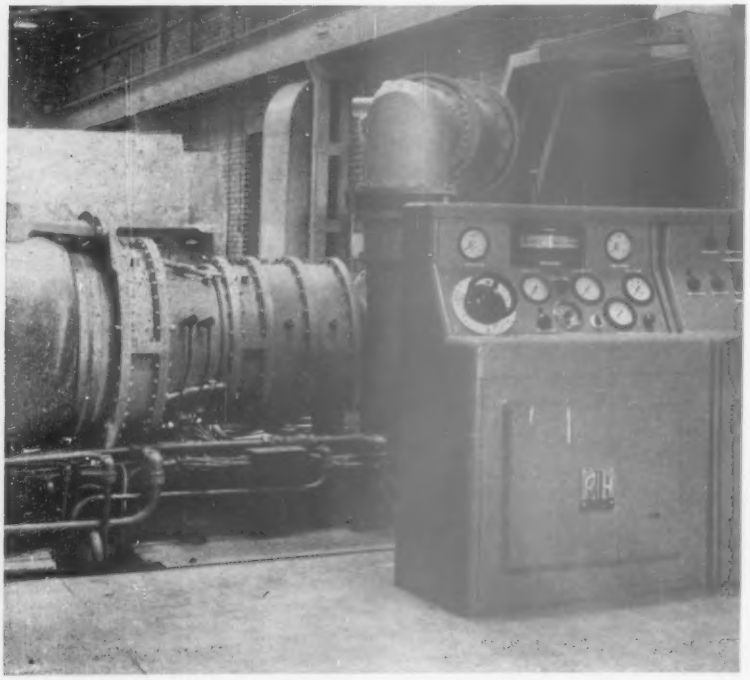
Reserves so far found by Oasis have been widely estimated as capable of producing a minimum of 100,000 bbl. daily.

A FLOWLINE valve is manned by a Kuwaiti at the Raudhatain separation and gathering center.



THE LINE from the field terminates at a new 3,878,000-bbl. capacity tank farm.

Raudhatain's Oil Is Now Moving to the South



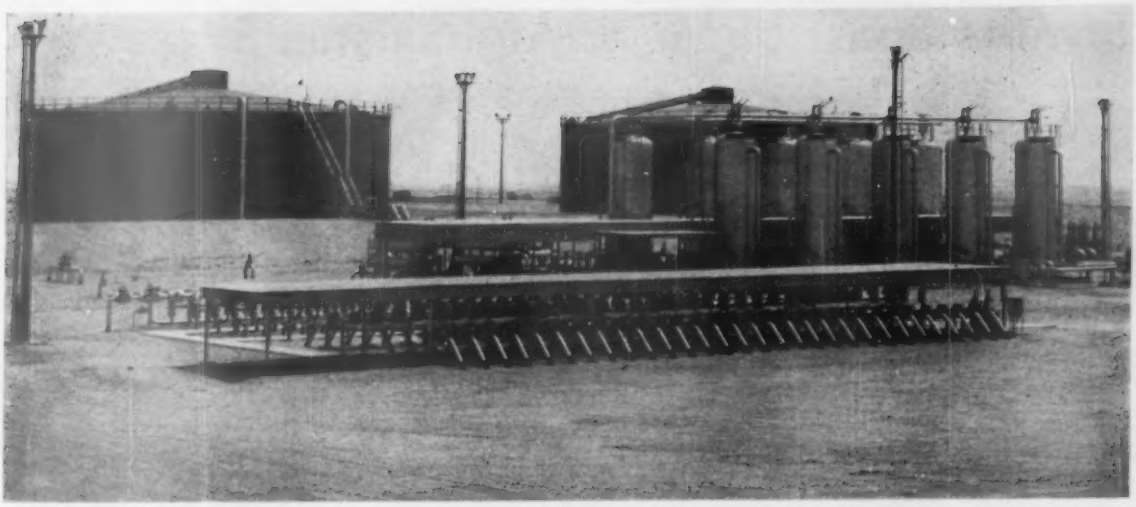
GAS TURBINES power the centrifugal pumps which move the crude south to the new terminal. There are three turbines, each with 900 hp., for the three pumps.

- A new crude line jumps possible Kuwait exports by 100,000 bbl. daily.

IN KUWAIT, where the spectacular in oil production is usually regarded as pretty commonplace, there was a pause and a ceremony last month to "cut the ribbon" and open up a new producing field.

The field isn't really new. Raudhatain was discovered in October 1955 and almost immediately became the source of more speculation than any single discovery in recent oil history. Raudhatain 1 was bottomed at 10,301 ft. after testing oil from the Upper Burgan to the Lower Cretaceous Zubair. It was completed in a thick section of the Burgan.

Between then and now Kuwait Oil Co., owned jointly by British Petroleum Co. and Gulf Oil Corp., completed 25 more Raudhatain wells. The reason for the "ribbon cutting" last month was the first time in the 5-year drilling and construction period that



FIELD FACILITIES at Raudhatain include an incoming manifold and the two 50,000-bbl. flow tanks in the background. Only 16 of the flowlines in the manifold are in use at the present time.

oil from North Kuwait flowed south to a new loading pier.

With one slice of the shears across a pretty ribbon, Raudhatain added a conservative 100,000 bbl. daily to Kuwait's already very respectable 1,500,000 bbl. daily oil production. The new field can easily supply more than twice its initial output and will when additional power facilities are added to move crude to the south.

The new 30-in., 63-mile pipeline is moving stabilized crude due south from the field, skirting the western end of Kuwait Bay and then southeast to the newly constructed North Tank farm on a 375-ft. elevation overlooking KOC's new North Pier. The tank farm has a total storage capacity of 3,878,000 bbl.

Three 40-in. gravity flow lines link the tank farm and the new pier and give the new terminal a loading rate of 50,000 bbl. an hour.

Field facilities . . . Raudhatain has Kuwait's fifteenth crude gathering and separation center. It is the only one outside of the old Magwa-Ahmadi and Burgan producing areas to the south.

Gas-oil separation is carried out in three stages. Five pairs of vertical separators, relatively novel for the Middle East, are used in the first two stages. Each pair of these separators has a 25,000 bbl. daily capacity. The final stage is carried out in two 50,000-bbl. flow tanks.

Only 16 flowlines are now in use in the incoming manifold which links 29 wells to the gathering center. In addition to the Raudhatain wells, completed wells at Sabriya, to the east and Bahrah, to the southeast, are connected with the gathering system.

The pump station to move the crude south by the 30-in. pipeline is equipped with three centrifugal pumps powered by three 900 hp. gas turbines in series.

Not so, says Dr. Perez Alfonzo, to rumors of outside capital in financing national operations

VENEZUELA'S OIL MINISTER last week scoffed at the idea that established private companies will do the drilling for the newly formed national oil company.

Dr. Juan Pablo Perez Alfonzo dismissed such current industry rumors as an "old wives' tale."

He said the very small initial capitalization of the new company at only Bs. 2,500,000 (about $750,000) had apparently led to the speculation that the company didn't have enough money to conduct its own operations. He pointed to the choice, semiproved acreage held by the new venture in Lake Maracaibo and other parts of the country as its additional assets. He values the acreage at more than Bs. 600,000,000 (about $180 million).

"The company will have no trouble financing its operation with that kind of collateral," the minister of mines and hydrocarbons insisted.

"Even the most conservative Wall Street bank would finance its operations if the company wanted to, but we are looking to internal financing as the proper way."

Dr. Perez Alfonzo said he has received "specific offers" from labor groups that want to buy bond issues to finance the operations of the national company.

"We would give preference to those labor groups because the profits then would remain in Venezuelan hands," he said.

Soviets Boast of Major Afghanistan Strike

• Big reserves are claimed after a one-well test. The Reds also state the country's entire northern territory has oil and gas potential.

THE RUSSIANS are thumping their oil drum again with claims of a major oil discovery made with Soviet technicians in the remote mountain country of Afghanistan.

Russian diplomatic sources in Washington last week claimed the discovery of reserves of 300,000,000 bbl. in a wildcat drilled near Aq Shah, north of the great Hindu Kush mountains and only 40 miles south of the Oxus River which separates the Soviet Union from Afghanistan.

There were no details on the discovery other than the reserve figures cited on the basis of the single well.

If the Russians have made a significant discovery for the Afghans, the find could pose new problems for the little country in its efforts to stay neutral in the East-West ideological conflict. The Afghan Government entered into the economic agreement with the Russians in July 1957, which called for Russian oil exploration in the northern part of the country. They have since repeatedly turned down Russian offers to finance the entire 5-year economic plan of the country.

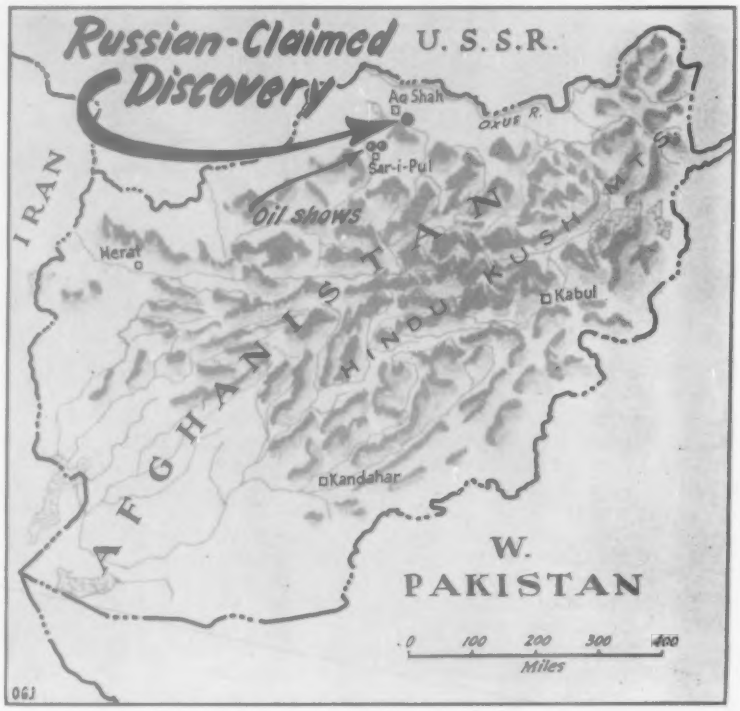
Afghan diplomats have said frankly that if oil is found in the country they would like to see it move into western markets, but moving any oil the Russians may have found over the terrific physical barrier posed by the Hindu Kush mountains is a major problem.

The word of the Afghanistan discovery comes on the heels of published optimistic reports from the Russians themselves on the oil prospects of northern parts of the country.

V. A. Frolov, chief geologist of the foreign relations section of the USSR's Ministry of Geological Survey and Conservation of Mineral Resources, talked about the area in rosy terms in Moscow recently after a visit to Afghanistan.

Frolov said then that the area's "oil and gas deposit potential" covers "the entire northern territory of Afghanistan." He added that geological structures found in the region have many features in common with oil-and-gas-bearing areas of Soviet Central Asia to the north.

"This is borne out by the results of drilling," Frolov insisted. "The first trial well, sunk at an early stage of geological survey in the vicinity of Sar-i-Pul, helped establish the presence of good oil reservoirs and yielded small flows of high-grade oil.



"A second well showed signs of the presence of both oil and gas. In addition to these two wells, we started preparations for drilling in two more promising areas."

One of these two more "promising" areas presumably is the Aq Shah region where the reported discovery was made. It is about 70 miles to the east-northeast of Sar-i-Pul.

Russian geologists have been working in the country for more than 2 years under the terms of the 1957 agreement. Most of the drilling work is being done by Romanians and Afghans using Russian drilling equipment.

The Russians claim they are going all out to train Afghans for work in the country's budding oil operations. They say more than 200 Afghans completed specialized training last year and another 250 are undergoing training this year.

Esso to Float Libyan Line Pipe Ashore

ESSO LIBYA is going to float its 100-mile pipeline ashore on the northern coast of Libya, 40 ft. at a time.

Faced with the prospect of unloading more than 26,000 tons of 30-in. pipe at Marsa Brega with no wharves, piers, or quays, Esso engineers decided to plug the ends of the pipe sections with plastic discs and float them ashore.

Tests carried out on Great Britain's northeast coast, where the pipe is being manufactured, proved the feasibility of the plan.

Once the pipe is floated from freighters in the 25-ft. water at Marsa Brega, small boats will be used to tow it ashore to a flat-top carrier on rails built into the shallow water. The carrier will move the pipe onto dry land for loading on trucks.

The floating plan is being credited to G. A. McCammon, Esso Libya engineer and formerly chief engineer for Creole Petroleum in Venezuela.

The first shipment of the pipe is slated to leave Britain's South Durham steel mill early in June and is due to arrive off northern Libya by June 20 when the floating operation will be started. The whole operation will probably take until sometime in November with a dozen freighters hauling the pipe from the mill.

Tapline's troubles with turbines

• Maintenance problems have been severe, but the company reports that it is steadily overcoming them and unit availability is high.

BY R. C. HILL, R. H. HUBBELL, AND H. L. KRAPP
Trans-Arabian Pipe Line Co.

H. L. Krapp is superintendent of mechanical maintenance responsible for maintenance of all Tapline machinery and supervision of the central mechanical shops. R. H. Hubbell is senior engineer responsible for coordinating engineering services to operations and maintenance departments; he was formerly with General Electric Co. gas-turbine division. R. C. Hill is senior engineer responsible for development and test projects and consultant to management on mechanical problems.

MANY PROBLEMS have caused severe maintenance conditions during the initial period of operation, but the basic concept of remotely controlled gas-turbine pumping units is believed sound.

The combined efforts of Trans-Arabian Pipe Line Co. and General Electric Co., the turbine manufacturer, have succeeded in meeting pumping requirements on the line from Saudi Arabian fields to the Mediterranean. Meanwhile permanent solutions for optimum use of the units have been found or are being worked out.

The original Trans-Arabian line, completed in 1950, had four diesel-engine-powered pumping stations about 160 miles apart. In 1955, when it became desirable to increase capacity, it was decided to pioneer with unattended remotely controlled gas-turbine units at intermediate points. Only occasional operation of the new portable units has been required since the end of March 1959, some 15 months after their installation. However, the first-quarter 1959 figures show that the lowest monthly availability for any of them was 75% and the highest 99.5%.

The 3-month averages for each of the four Tapline units were 90, 97.3, 96, and 96%, with the combined average being 94.8%. These records were achieved while the pipeline was moving oil at the rate of 379,000 bbl. daily in January, 442,000 bbl. daily in February, and 462,000 bbl. daily in March 1959.

Problems affecting the maintenance of power capability have been severe. Individual units have deteriorated as much as 50% of rating during very short periods of service. Units will have to be modified somewhat to overcome the problems of handling crude oil in these high-capacity packages in the desert environment. Progress in solving maintenance ills indicates long-term capability of more than 90% of rating. (A 100% operating factor would require the unit be capable of delivering 4,450 h.hp. at the pump discharge 100% of the time. The units are rated at 5,000 b.hp. for continuous operation at 100° F. ambient temperature and 2,600-ft. elevation.)

Remote control has become routine since completing the VHF radio system and has proved quite reliable.

Adapted from a paper presented at the Gas Turbine Power and Hydraulic Conference, ASME, Houston.

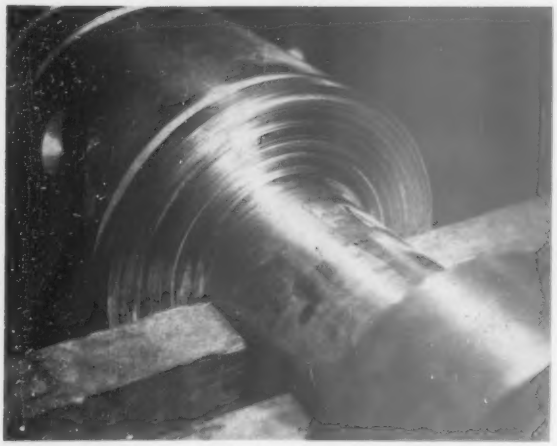
Mechanical Problems

Bearings. While the auxiliary pumping units were en route to Saudi Arabia, other machines of similar design and in similar service were suffering severe damage to the second-stage rotor and its bearings (Fig. 2). The nature of the damage indicated that the single-piece wheel and shaft of forged type-422 steel was not a good bearing material because a scratch or burr on the bearing surface would not heal.

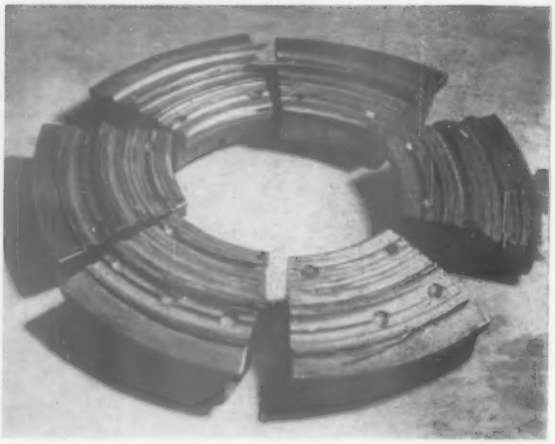
The disrupted bearing surface caused by the scratch or burr would transfer to the bearing babbitt and by rapid formation of other burrs it would destroy both bearing surface and bearing. The manufacturer recommended that the bearing journals and thrust runner be chromium plated. However, failures were then experienced with plated rotors.

Inspection of a rotor which had not

SPARE AUXILIARY PUMPING unit operates at Shubah, Saudi Arabia, while another unit is repaired. Fig. 1.



SECOND-STAGE TURBINE ROTOR had failure of chrome-plated crucible 422 thrust runner. Fig. 2.



SECOND-STAGE TURBINE THRUST bearing after failure. Modifications have stopped trouble. Fig. 3.

failed showed evidence that the chrome plating would flake off if it was poorly bonded to the rotor. There was also evidence of nonuniformity in the thickness and mosaic cracking of the plating. The inspection of another rotor showed a metal chip imbedded in the thrust runner. Such a condition probably would trigger bearing failures. The rotors were further modified by machining the shaft from the wheel and installing a bolted and doweled type-4140 steel shaft to the wheels.

Another contributing factor to the bearing failures was found in the Kingsbury thrust bearing. Oil-flow control spaces between the thrust shoes were acting as pumps. Pumping action put the bearing under negative pressure, allowing air to pass into the bearing and become entrained in the oil. The resulting foaming and marginal lubrication under certain conditions caused localized hot spots that could start failures even though the bearing loading was conservative (Fig. 3).

The thrust-bearing design was modified to put the bearing under a positive lube-oil pressure. No bearing or rotor failures have occurred since.

First-stage nozzles. The rapid deterioration of first-stage nozzles has been part of the over-all problem in using Arabian crude as a gas-turbine fuel. The standard combustion-chamber arrangement developed with complete success for gas firing, and which is reported to give moderately good results with residual fuel, has not worked satisfactorily for crude oil.

As a result the first-stage nozzles rated at 1,450° F. average firing temperature have been consistently subjected to peaks in the order of 2,000° F. This has resulted in nozzle life of about 2,000 hours before warping and corrosion of partitions (Fig. 4) have caused excessive power loss.

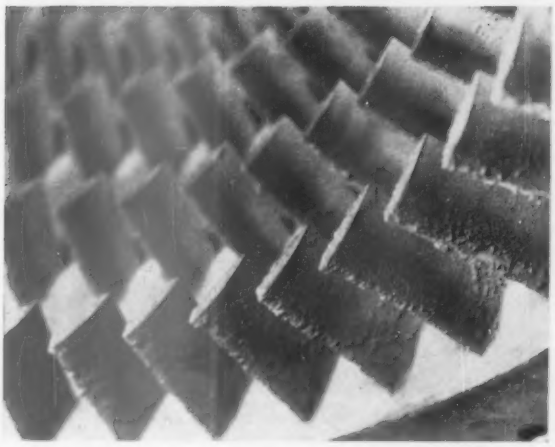
Preliminary investigation showed that combustion-chamber performance under actual operating conditions was much less stable than factory test-stand results. This may be due to a difference between crude drawn directly from the pipeline and used as fuel and crude which has lost part of the lighter ends during handling in small quantities. Also, the corrosion-inhibiting fuel additive was not being mixed effectively with the fuel, allowing excessive corrosion to occur on the nozzle partitions.

Combustion System

The combustion system used on the simple-cycle machines is made up of four removable sections and a transition piece. The system has had failure of clips, and unequal annular clearance at the joints. The result was disrupted cooling-air flow and distorted combustion-temperature pattern with hot spots on the liner walls and in the first-stage nozzle. Inspection at 1,500 to 2,000 hours of operation invariably revealed broken support clips and the resulting evidence of overtemperature of the liner walls and first-stage nozzle. Several modifications and tests in actual service have corrected these troubles. Inspection of the first set of modified liners shows no significant deterioration of the liners or first-stage nozzle after 4,500 hours.

First-stage buckets. Except for some bucket corrosion and bucket-tip rub from a warped shroud there have been no particular problems during operation. Both conditions were probably caused by higher-than-normal combustion temperatures and local overheating. We have noted a slow rate of pitch-line erosion and a notch-shaped

FIRST-STAGE NOZZLE of gas turbine is shown after 5,400 fired hours. Fig. 4.



STATOR BLADING of axial-flow compressor shows oily carbonaceous deposits. Fig. 5.

ASH DEPOSITS formed on second-stage turbine rotor; cleaning method is being tried. Fig. 6.

erosion pattern in a low-stress area of the bucket platform at the trailing edge. One first-stage wheel has been returned to the factory for a new rim. The wheel had numerous cracked hooks in the bucket dovetails, again the result of high temperatures in the dovetail area.

Second-stage nozzles. On the two-shaft turbines the second-stage nozzles are of variable-pitch design to control the speed of the compressor set. Nozzle position is controlled by level and link connections to the hydraulically powered control ring. Shortly after the machines were started up another installation of similar design had second-stage bucket failures from vibration induced by unequal second-stage nozzle discharge areas.

Inspection of the nozzle-stem aluminum shear pins for failure and the installation of steel shear pins was undertaken. Some distress on the steel pins has become apparent and they are being replaced with a key. The key maintains positive orientation of the stem and actuating arm, and operation since the modification has been satisfactory.

Second-stage buckets. Two sets of second-stage buckets have been found with some of the buckets developing cracks at the root of the top hook of the fir tree. All of the buckets have been modified to relieve high-stress concentrations in the bucket and wheel fir-tree areas. The effectiveness of relieving the high-stress concentrations in the bucket hasn't been established.

The second-stage buckets of crucible 422 alloy generally show some corrosion weight loss. One set had a pitting corrosion under the surface scale on the vane of the bucket.

Fouling. Fouling of the compressor takes the form of solid particles of dust or soot sticking to stator blading and to a lesser degree on the rotating blades. Fouling has been reduced by adding 20-ft.-high exhaust-stack extensions to minimize recirculation of exhaust smoke and by locating lube-oil tank vents as far from the air inlet as is practicable.

Cleaning the compressor during operation by injecting dry abrasive into the inlet has been partially effective. But it does not remove upstream stator deposits (Fig. 5). Horsepower recovery varies from 300 to 700 including the effect of the abrasive passing from the compressor through the turbine. Rate and magnitude of the fouling vary from machine to machine but appreciable magnitudes occur in a very few hours. The viscous-impingement-type inlet-air filter seems to be neutral to lube-oil vapor, neither removing nor adding to the concentration.

Turbine fouling takes the form of ash deposits which adhere to turbine-nozzle partitions and buckets, destroying the air-foil contours (Fig. 6). The deposits build to a maximum thickness of about ⅛ in. and crack off erratically during operation and during the expansion and contraction of starting and shutdown.

Water washing through the disassembled combustion chambers is partially effective on the first-stage nozzle. This method is not desirable because water and dissolved deposits may be carried into the bearings, and shutdowns with relatively long cool-down periods are required. A device to inject a resilient abrasive has been fabricated to allow cleaning the turbine section without first passing the cleaning material through the compressor. It appears to be practical, but further testing is needed to evaluate.

Main crude-oil pump. The main crude-oil pumps have performed well. Initially there was rapid deterioration of mechanical seals which were being eroded by fine sand. The seal cooling-oil circuits were modified to reduce this problem. The sand problem is expected to be eased further as old line deposits are moved out by high flow rates.

Pumps are of a new design which extends the empirical limits of capacity and speed for pipeline pumps. Speed goes as high as 6,000 r.p.m. At high operating speeds there is a cavitation condition which is apparently a function of relative oil-to-impeller velocity.

The high relative velocity results in suction-pressure requirements higher than normally expected. Cavitation erodes the impeller vanes in the suction area with eventual breaking out of sections of the vanes after about 4,500 hours (Fig. 7).

During development of new impellers, minimum suction pressures are being controlled at relatively high levels when operating at high impeller speeds to minimize cavitation conditions. Replacement impellers are of type-316 stainless steel which has superior resistance to cavitation damage. The new impellers will also be hand-polished to reduce starting points for cavitation.

All type-410 stainless impellers now in service show some cavitation damage.

Sundstrand Fuel Pump

Fuel supply to the turbine is metered and distributed by an 18-cylinder hydraulically controlled positive-displacement pump. At first pump cooling and lubrication were supplied by crude oil, but this was abandoned because of bearing failures (Fig. 8) and corrosion of the hydraulic control relay. Conversion to

BROKEN VANES of centrifugal-pump impeller resulted from cavitation erosion. Fig. 7.

BEARINGS FAILED in fuel pump because of lubrication with sour crude oil. Fig. 8.

turbine lube-oil lubrication eliminated those problems but increased lube-oil consumption and piston sticking.

Considerable evidence indicates that the type of lube oil and the fuel temperature influence piston sticking to a major degree. Fuel temperature must be kept around 125° F. for good operation. There are indications that zinc sulfide deposits are forming owing to interaction between the lube oil and crude and are causing the pistons to stick. Fuel-pump operation has been improved by using a lube oil which does not contain a zinc additive, by close control of fuel temperatures, and improved additive dispersion. But completely satisfactory operation has not yet been achieved.

Second-stage-nozzle control. At first the electrohydraulic second-stage-nozzle position regulators gave trouble in both the electric and hydraulic circuits. The electrical problem was overcome by supplying cooling air to the feedback rheostat located on the turbine shell to prevent contact and bearing failure. The hydraulic problem which was due to leakage and pilot valve sticking, required modification of the valve clearance and seals.

Hydraulic safety-trip circuit. Numerous starting failures have been alleviated by modifying devices to reduce control-oil leakage. This overcomes a marginal supply of oil to the hydraulic safety-trip circuit during the starting cycle.

Control Problems

Temperature scanners. Critical points in the turbine and associated equipment are equipped with thermocouples connected to temperature recorders which continuously monitor the operating temperatures. The scanners are connected to the alarm and trip circuits for automatic protection.

As originally installed the equipment was not reliable enough—an alarm or trip condition could exist without being announced and frequent shutdowns were made when no trip condition existed. The temperature-scanning equipment was made reliable by several changes: alarms are interlocked with trips for positive indication of cause; switching devices have poistive closing and contact wiping. Painting the inside of the cases with white enamel has greatly improved visibility for maintenance.

Temperature control. Turbine firing-temperature control is provided by a pneumatic system with the actual temperature-measuring elements being differential-expansion probes mounted in the turbine-exhaust stream. Expansion of the probes is converted into a pneumatic signal which is inversely proportional to temperature.

The individual output pressures are fed through averaging, biasing, and reset relays to the fuel-regulator thermal unit which reduces fuel if the inlet-temperature limit is reached. The major fault with this system is that it may not give a true indication of inlet temperatures. Erratic temperatures resulting from poor combustion in individual combustion chambers tend to average out by the time they reach the two exhaust-temperature-detecting probes. It is possible, therefore, to cause severe damage to the turbine while the control sees temperatures within operating limits.

The exhaust-temperature thermostats are a chronic maintenance problem because of poppet-valve wear. This requires constant adjustment and replacement. Reinforcing the turbine-exhaust hood to reduce vibration has sharply reduced poppet-valve wear.

Process control. The control of suction and discharge pressures with necessary overrides, adjustments, and data transmittal is essentially a pneumatic system with electropneumatic transducers where required. As originally installed the control was unstable during transfer between suction and discharge control using selector relays. This caused a violent hunt in the turbine-speed control. Converting the system to series override control and elimination of the selector relays solved the problem.

After a short time, the suction and discharge transmitters could not be kept in operation because of mechanical vibration and pressure pulsation. The transmitters had to be moved away from their mounting location adjacent to the main-line pump and into a relatively vibration-free installation outside the turbine and pump van. The system was made more reliable by eliminating some duplicate functions such as the exhaust-temperature override control which backed up two other independent protective systems.

Wide ranges in ambient temperatures caused errors in the electrical transducer signals because of changes in circuit resistance. Thermal compensation was added because control and data errors could not be tolerated when operating at pipeline stress limits. This has been partially successful.

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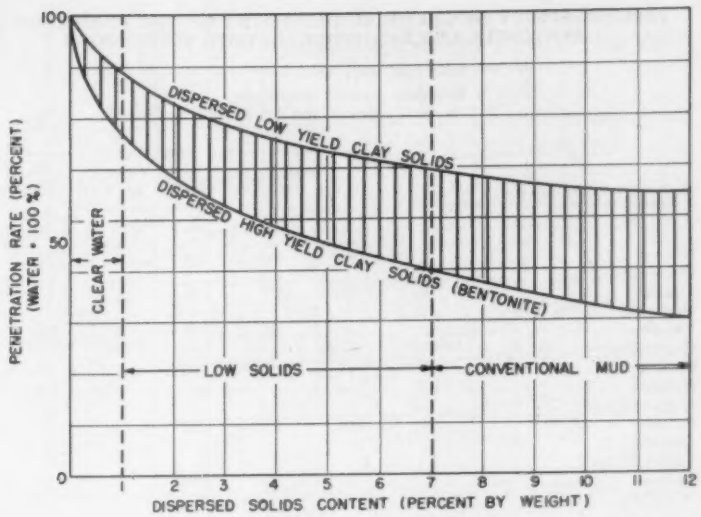
DRILLING SPEED FALLS with each added measure of solids in the mud. Low-yield (drilled) solids aren't quite so harmful as the high-yield solids such as bentonite which are added to the mud intentionally. Fig. 1.


100
50
0
PENETRATION RATE (PERCENT) (WATER = 100 %)
DISPERSED LOW YIELD CLAY SOLIDS
DISPERSED HIGH YIELD CLAY SOLIDS (BENTONITE)
CLEAR WATER
LOW SOLIDS
CONVENTIONAL MUD
1 2 3 4 5 6 7 8 9 10 11 12
DISPERSED SOLIDS CONTENT (PERCENT BY WEIGHT)

New chemical, cyclone separator team up in

Maintaining low-solids drilling fluids

BY ARTHUR PARK, P. P. SCOTT, JR., and J. L. LUMMUS
Pan American Petroleum Corp., Tulsa

USING a new chemical to replace part of the bentonite in a drilling mud can speed up drilling rate.

All other factors equal, the fewer dispersed solids in a mud, the faster drilling rate is. And this chemical inhibits the hydration and dispersion of cuttings into the mud. Moreover, the powdered free-flowing polymer (Polygel, distributed by Rotary Drilling Services, Inc., through Cherokee Laboratories, Inc.) can double yield of bentonite, when used along with soda ash. Thus, there are fewer drilled solids and fewer gel solids in the mud. Nevertheless, the chemical and soda-ash-treated mud still has enough viscosity to remove the cuttings from the hole and keep it in good condition.

Paper presented under Title, "Chemical and Mechanical Means of Maintaining Low-Solids Drilling Fluids," at 1960 spring meeting of API Division of Production's Mid-Continent District, Wichita.

TABLE 1—EFFECT OF CONCENTRATION OF SODIUM CARBONATE ON VISCOSITY OF 3% BENTONITE SUSPENSIONS TREATED WITH A POLYMER
(Polymer concentration: 0.05 lb./bbl.)

Concentration of sodium carbonte, lb. per bbl.	Stormer viscosity, cp.
0	20
¼	24
½	28
¾	29
1	30
1¼	30
1½	32

Only a little of the polymer and soda ash is needed. Optimum concentration of the polymer is only 0.05 to 0.1 lb. per bbl. of mud; optimum for the soda ash is only 1 lb. per bbl.

A further aid in keeping solids content low is a new design of cyclone separator for the mud. This design has a 14° cone angle and is 14 in. in diameter. Its underflow nozzle is 1½ in. and the vortex finder is 5 in. With this design, 99% of all solids coarser than 230 mesh can be removed. Moreover, the cyclone won't reject mud out of the underflow as other designs do when the feed is free of cuttings.

Effect of solids. Fig. 1 shows the effect dispersed clay solids have on drilling rate. The upper curve shows that as content of dispersed low-yield solids such as native clay goes up, drilling rate goes down. The lower curve shows the same effect with increased concentration of dispersed high-yield clay such as bentonite. The shaded portion of the curves is the

TABLE 2—PROPERTIES OF BENTONITE SUSPENSIONS TREATED WITH A POLYMER AND SODIUM CARBONATE (Soda Ash)

	Concentration of Polymer (lb./bbl.)									
	0		0.025		0.05		0.10		0.20	
Conc. soda ash (lb./bbl.)	0	1	0	1	0	1	0	1	0	1
3% bentonite										
Plastic vis. (cp.)	2	..	4	8	4.5	9	4.5	9	6	9
Yield value (lb./100 sq. ft.)	1.5	..	2	12	1	14	2	14	3	6
Funnel vis. (sec.)	30	..	33	39	32	41	33	45	37	45
Fluid loss (cc./30 min.)	26	..	..	..	23	25	17	22	16	16
Stormer vis. (cp.)	6	..	..	28	..	30	..	32	..	33
4% bentonite										
Plastic vis. (cp.)	4	6	10	11	12	12	10	16	13	22
Yield value (lb./100 sq. ft.)	1	13	15	25	10	31	6	32	18	27
Funnel vis. (sec.)	32	43	48	56	49	66	45	126	55	292
Fluid loss (cc./30 min.)	22	26	22	24	21	23	15	20	14	13
Stormer vis. (cp.)	8	..	..	..	..	..	..	..	..	..
5% bentonite										
Plastic vis. (cp.)	6	7	15	25	18	19	18	19	26	34
Yield value (lb./100 sq. ft.)	2	23	30	40	22	57	15	64	22	54
Funnel vis. (sec.)	34	50	99	176	111	270	86	..	..	..
Fluid loss (cc./30 min.)	19	20	..	..	..	..	..	..	..	..
Stormer vis. (cp.)	13	..	..	..	..	..	..	..	..	..
6% bentonite										
Stormer vis. (cp.)	22	..	..	..	..	..	..	..	..	..

TABLE 3—EFFECT OF CHEMICAL TREATMENT ON THE PROPERTIES OF BENTONITE AND BENTONITE-POLYMER SUSPENSIONS

A=5% bentonite suspension
B=5% bentonite-ploymer suspension
(0.1 lb./bbl. polymer and 1.0 lb./bbl. soda ash)

Treatment	Conc. (lb./bbl.)	Properties: Plastic Vis. (cp.) A	Plastic Vis. (cp.) B	Yield Value (lb./100 sq. ft.) A	Yield Value (lb./100 sq. ft.) B	Fluid Loss (cc./30 sec.) A	Fluid Loss (cc./30 sec.) B
None	...	14	18	38	53	14	16
Quebracho	⅛	...	...	...	...	...	...
Caustic	⅛	12	22	19	23	...	15
Quebracho	¼	...	...	...	...	...	...
Caustic	¼	13	9	13	4	11	14
Quebracho	1	...	...	...	...	...	...
Caustic	1	12	...	2	...	12	...
Calcium Lignosulfonate	¼	...	...	...	...	...	...
Caustic	½	14	12	108	21	...	15
Calcium Lignosulfonate	1	...	...	...	...	...	...
Caustic	1	14	10	126	21	12	14
Modified Lignosulfonate	¼	...	...	...	...	...	...
Caustic	¼	14	13	23	20	...	14
Modified Lignosulfonate	½	...	...	...	...	...	...
Caustic	1	17	10	49	9	11.5	...
Mangrove bark	¼	...	...	...	...	...	...
Caustic	¼	13	19	16	18	...	16
Mangrove bark	½	...	...	...	...	...	...
Caustic	1	14	12	33	5	12	...
Lignite	¼	...	...	...	...	...	...
Caustic	½	18	10	33	9	...	16
Lignite	½	...	...	...	...	...	...
Caustic	½	13	8	7	3	13.5	...
SAPP	⅛	13	10	6	5	12.5	16

TABLE 4—EFFECT OF CONTAMINANTS ON PROPERTIES OF BENTONITE SUSPENSIONS

Suspension	Contaminant	Conc. (lb./bbl.)	Plastic Vis. (cp.)	Yield value (lb./700 sq. ft.)	Funnel Vis. (sec.)	Fluid Loss (cc./30 sec.)
5% bentonite	...	...	6	7	38	17
5% bentonite	Sodium chloride	½	6	18	45	19
5% bentonite	Calcium sulfate	1	5	18	46	52
3% bentonite	...	...	3	3	33	24.5
3% bentonite	...	...	...	...	...	...
0.025 lb./bbl. polymer	...	...	...	...	...	...
1.0 lb./bbl. soda ash	Sodium chloride	⅛	8	9	42	26.00
1.0 lb./bbl. soda ash	Sodium chloride	¼	8	8	41	26.00
1.0 lb./bbl. soda ash	Sodium chloride	½	8	8	42	27.00
1.0 lb./bbl. soda ash	Sodium chloride	¾	8	8	42	25.5
1.0 lb./bbl. soda ash	Sodium chloride	1	...	...	...	30.0
1.0 lb./bbl. soda ash	Sodium chloride	1½	...	...	...	37.0
1.0 lb./bbl. soda ash	Calcium sulfate	1	10	6	43	28

effect of various proportions of both types of solids.

There may be as much as a 50% drop in drilling rate when drilling fluid has more than 5% by weight of dispersed high-yield clay.

Unfortunately when we use a mud with few solids, we often have hole problems which we can remedy only with mud properties that go with higher dispersed-clay content. Thus, we need chemicals to improve the lower-solids muds and a means to aid in removing the drilled solids and sand from the mud.

The tests described in this article were made in the search for such chemicals and solids-removal devices.

Polymer tests. We treated several suspensions of bentonite with a new polymer. Then, we used various concentrations of soda ash in a 3% bentonite suspension containing 0.05 lb. per bbl. of the polymer. Table 1 shows the results. When we added 1 lb. of soda ash per barrel of mud, Stormer viscosity increased from 20 cp. to 30 cp. Another ½ lb. of soda ash caused an increase of only 2 cp. Thus, optimum concentration of soda ash appears to be about 1 lb. per bbl.

We then varied the concentration of polymer while holding 1 lb. of soda ash per barrel of mud. Table 2 shows the effect on viscosity and fluid loss of the bentonite suspensions. As the table shows, fluid loss goes down as polymer is added.

Figs. 2 and 3 show how the polymer affects funnel and plastic viscosities. As polymer concentration increased, the plastic viscosity increased rapidly until there was 0.05 to 0.1 lb. of polymer per barrel. Above 0.1 lb. per bbl., viscosity increased but slowly.

The effect was about the same with Stormer viscosity.

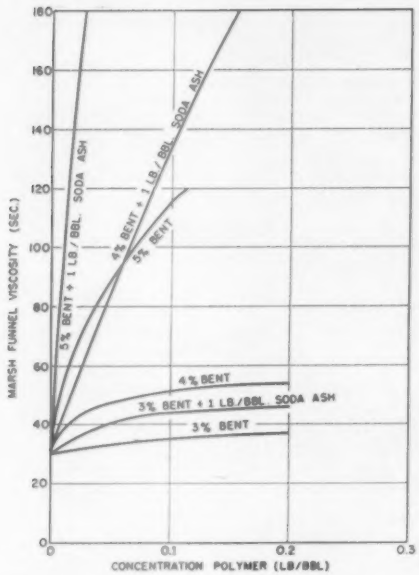
In general, funnel viscosity seemed

TABLE 5—PERFORMANCE OF 14-IN. CYCLONE WITH 3%

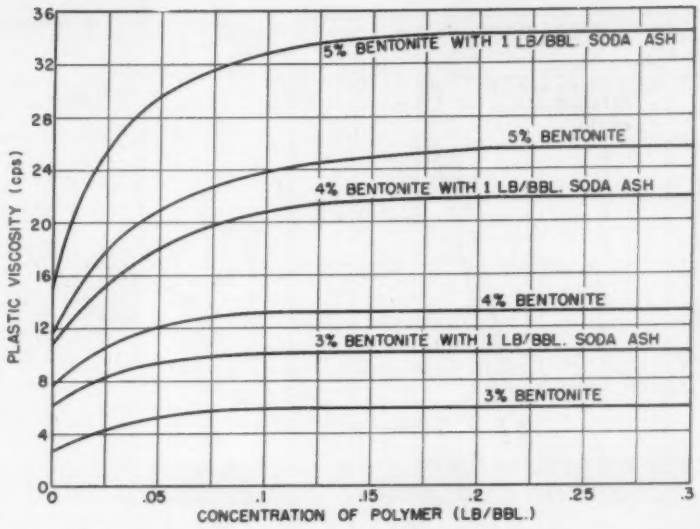
(0.1 lb./bbl. polymer and 1 lb./bbl. soda ash.) Cuttings: 15 lb./bbl. (4 to 230-mesh sand.)

Test No.	Vortex finder dia. (in.)	Underflow dia. (in.)	Overflow dia. (in.)	Input pressure psi.	Input rate (bbl./min.)	Percentage of each mesh size removed: +12	−12 to +16	−16 to +60	−60 to +100	−100 to +230
1	5	1	6	45	14	100	100	98.0	93.0	42.3
2	5	1	6	38	11.5	100	100	97.7	90.4	36.5
3	5	1½	6	45	14.0	100	100	97.7	96.5	63.4
4	6	1	8	42	14.8	100	100	97.0	91.8	39.1
5	6	1½	8	42	14.8	100	100	97.3	91.8	41.5
6	7	1½	8	42	14.8	100	100	98.0	85.0	36.4
7	5	2	6	42	14.8	100	100	99.4	97.5	72.5
8	5	2	*6	42	14.8	100	100	97.2	95.7	71.2
9	4	1	6	50	13.4	100	100	96.9	95.5	85.5
10	4	1	*6	50	14.2	100	100	100.0	98.9	90.5
11	4	1	6	38	10.9	100	100	100.0	95.0	56.5
12	4	1	*6	38	11.5	100	100	96.0	96.6	60.8
13	4	1½	6	50	13.3	100	100	96.8	97.0	82.5
14	4	1½	*6	50	13.3	100	100	100.0	97.5	74.5
15	4	1½	*6	38	11.4	100	100	100.0	94.0	54.5

*Underflow submerged. †Automatic flow: No mud lost from underflow when feed contains no cuttings.


MARSH FUNNEL VISCOSITY (SEC.)
CONCENTRATION POLYMER (LB/BBL)
5% BENT + 1 LB/BBL SODA ASH
4% BENT + 1 LB/BBL SODA ASH
5% BENT
4% BENT
3% BENT + 1 LB/BBL SODA ASH
3% BENT

LITTLE POLYMER goes long way in increasing funnel viscosity of bentonite. Note that about 0.05 lb. of the polymer per barrel of mud is about the best for 3% bentonite; the same amount in 4% or 5% bentonite puts funnel viscosity as high as usually needed. Fig. 2.


PLASTIC VISCOSITY (cps)
CONCENTRATION OF POLYMER (LB/BBL.)
5% BENTONITE WITH 1 LB/BBL. SODA ASH
5% BENTONITE
4% BENTONITE WITH 1 LB/BBL. SODA ASH
4% BENTONITE
3% BENTONITE WITH 1 LB/BBL. SODA ASH
3% BENTONITE

FAST EFFECT ON PLASTIC VISCOSITY is shown in this chart. About 0.05 lb. of the polymer raises plastic viscosity of the bentonite suspensions to about the maximum. This is about the optimum concentration. Fig. 3.

to reach no optimum as more polymer was added. This difference between the plastic and Stormer viscosities and the funnel viscosity may be a result of the effect of gel strength in the funnel measure.

Fig. 4 compares the yield of treated and untreated bentonite; yield is in barrels of 15-cp. mud per ton of clay. Untreated bentonite yielded 107 bbl.; the bentonite treated with 0.05 lb. of polymer per barrel and with soda ash yielded 213 bbl. That is, the yield doubled.

Fig. 5 shows some unusual effects that resulted when Pennsylvanian-shale cuttings were used to contaminate bentonite suspensions. The 3% bentonite mud had 0.1 lb. of polymer and 1.0 lb. per bbl. of soda ash; original viscosity was 20 cp. Fifteen-pounds of shale per barrel decreased viscosity to 14 cp.

The shale increased the viscosity of the untreated bentonite suspension.

From this test, we can conclude that the polymer inhibits the hydration and dispersion of native solids.

BENTONITE-POLYMER SUSPENSION

Automatic † Flow	Underflow rate total g.p.m.	Underflow rate mud only g.p.m.	Concentration cuttings in overflow lb./bbl.	Total cuttings removed %
Yes	13.0	8.2	2.42	98.8
Yes	12.4	7.8	2.74	98.3
Yes	13.9	8.3	1.75	99.2
No	12.2	8.4	2.58	98.8
No	14.6	10.1	2.44	98.9
No	21.0	17.5	2.98	98.6
No	22.5	16.8	1.43	99.3
No	10.7	7.0	1.35	99.4
Yes	9.1	4.9	0.72	99.6
Yes	6.0	3.4	0.39	99.8
Yes	5.4	3.2	1.85	98.9
Yes	5.66	3.1	1.80	98.9
Yes	16.6	12.9	1.51	99.3
Yes	10.0	5.9	1.32	99.4
No	6.0	4.1	2.03	99.0

Faster drilling. To test the effect of the polymer, we used it in our laboratory drilling apparatus. We found that a 3% bentinite suspension treated with the polymer and soda ash drilled 12.5 times faster in sandstone than an untreated 5% suspension.

From this test, you can conclude that drilling rate can be increased by using the polymer to replace part of the bentonite in drilling mud.

We then tested the polymer in field drilling. The well was in Martin County, Texas, and Fig. 6 shows the results. The polymer-treated mud cut rotating time from 192 to 142 hours in the 900-ft. test interval. This is a 25% saving, or about $5,000 in rig time alone.

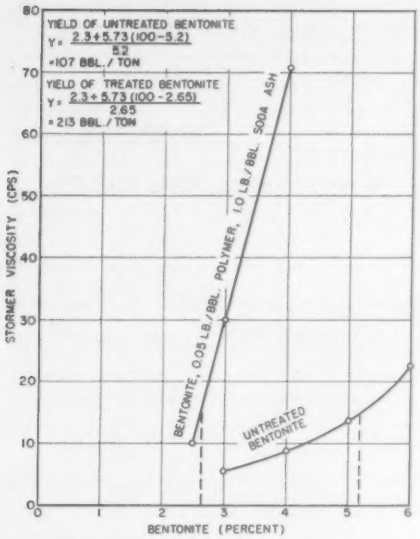
Moreover, the treated mud cost 8% less than the untreated. Bit costs were about the same. There were no unusual drilling problems with the polymer.

Stable to contamination. Table 4 compares the effect of sodium chloride and calcium sulfate on an untreated 5% bentonite suspension and on a 3% suspension with polymer and soda ash. One-half pound of sodium chloride and one pound of calcium sulfate per barrel increased viscosity and fluid loss in the untreated suspension. The same chemicals in the same concentration caused only slight changes in viscosity and fluid loss in the treated suspension.

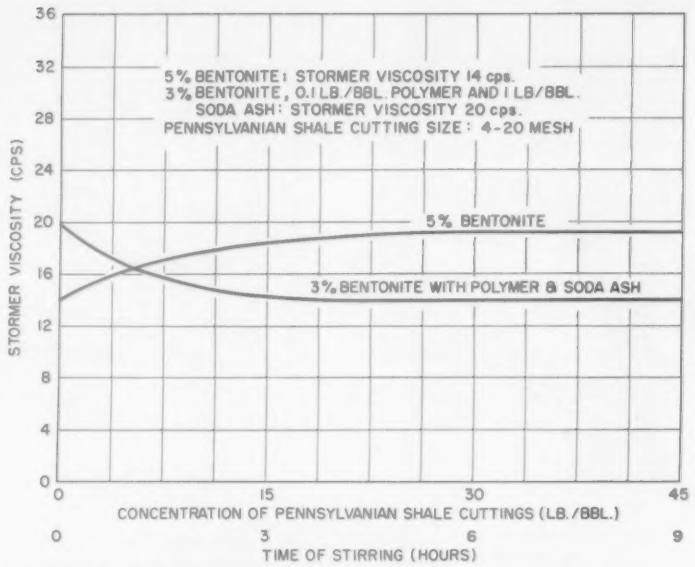
One and one-half pounds of sodium chloride increased fluid loss of the treated suspension. This indicates bentonite suspensions with the polymer and soda ash are more stable to contaminants such as sodium chloride and calcium sulfate. Also, the polymer begins to lose its effectiveness when there is more than 1 lb. of sodium chloride per bbl. (approximately 3,000 p.p.m.).

What it costs. Table 3 shows that conventional dispersants or viscosity-reducing agents, such as caustic quebracho and sodium acid pyrophosphate (SAPP), were equally effective in the suspensions. Thus, viscosity of bentonite suspensions treated with soda ash and the polymer may be controlled with conventional mud viscosity-reducing agents.

The polymer should reduce initial mudding-up costs. If it doubles the yield of bentonite as shown in Fig. 4, the cost of making 1,000 bbl. of 15-cp. mud with treated bentonite would be $83 less than 1,000 bbl. of 15-cp.



DOUBLE THE YIELD of bentonite is result of adding new polymer and soda ash. Thus, only about one-half as much bentonite is necessary to get the same mud viscosity. As Fig. 1 shows, the less bentonite, the faster drilling. Fig. 4.


5% BENTONITE: STORMER VISCOSITY 14 cps.
3% BENTONITE, 0.1 LB./BBL. POLYMER AND 1 LB/BBL. SODA ASH: STORMER VISCOSITY 20 cps.
PENNSYLVANIAN SHALE CUTTING SIZE: 4-20 MESH
5% BENTONITE
3% BENTONITE WITH POLYMER & SODA ASH
STORMER VISCOSITY (CPS)
CONCENTRATION OF PENNSYLVANIAN SHALE CUTTINGS (LB./BBL.)
TIME OF STIRRING (HOURS)

DRILLED CUTTINGS DON'T RAISE VISCOSITY of the mud with the polymer as they do with the untreated 5% bentonite mud. Viscosity of the 3% bentonite suspension was higher at start because of the polymer, but adding cuttings had no harmful effect as with 5% suspension. Fig. 5.

mud prepared with untreated bentonite.

Cost of 1,000 bbl. of 15-cp. mud prepared with untreated bentonite	$439
Cost of 1,000 bbl. of 15-cp. mud prepared with treated bentonite	$356
Saving	$ 83

Although the saving for 1,000 bbl. of mud appears small, total saving in bentonite during the drilling of a well could be great.

Cyclone tests. Tests were made on cyclone separators as an aid to removing mud solids. The 14-in.-diameter cyclone tested was as follows:

Cone angle, deg.	14
Feed diameter, in.	3
Overflow diameter, in.	6 and 8
Vortex finder diameter, in.	4, 5, 6, and 7
Underflow diameter, in.	1, 1½, and 2

Table 5 is a summary of the results with the 14-in. cone. Under optimum conditions, the cyclone removed from mud more than 99% of all cuttings coarser than 230 mesh. This efficiency is as good as that with 6 and 8-in. cyclones.

Of real importance is the fact that cuttings as large as ¾ in. in diameter passed freely from the 1½-in.-diameter underflow. Thus, the 14-in. cyclone could be used on mud systems which have bypassed a shale shaker. In smaller cyclones, large cuttings tend to plug the underflow orifices.

Results were best using a 4 or 5-in.-diameter vortex finder and a 1 or 1½-in.-diameter underflow orifice.

A unique feature of the large cyclone is that flow from the underflow stops when the feed mud contains no cuttings. This is a great advantage where cyclones are used continuously unattended. If a mud system were cleaned of all cuttings and sand, it would not be necessary to shut down the cyclone to avoid loss of good mud from the underflow.

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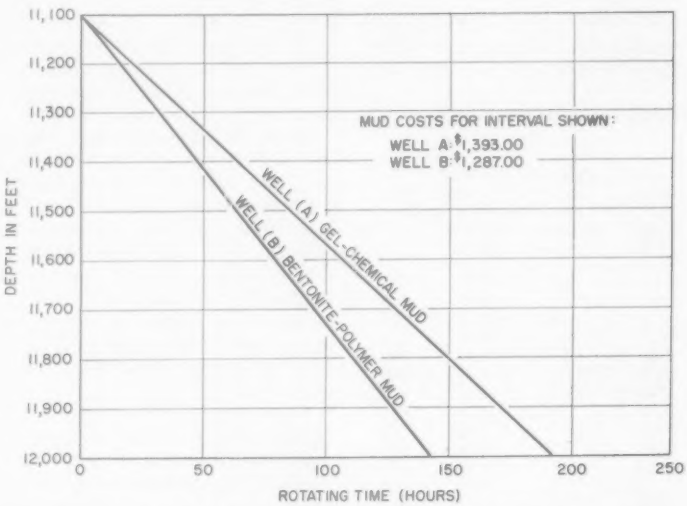
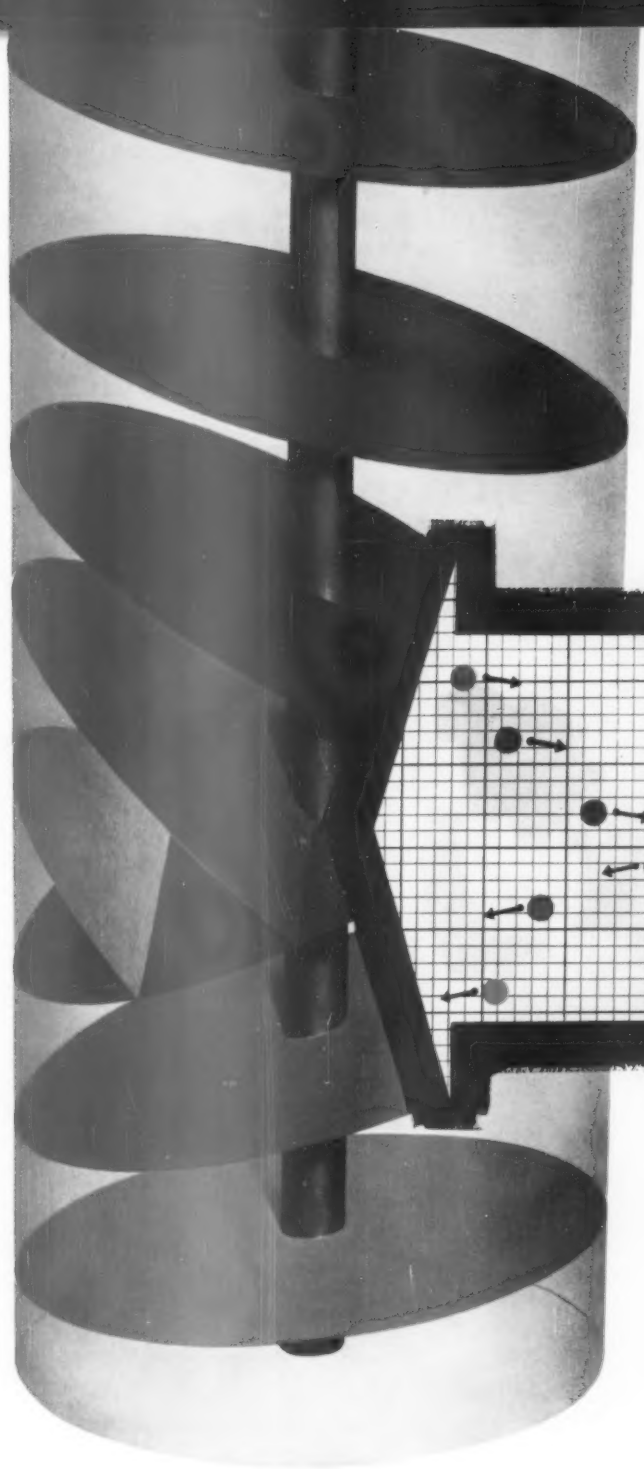


FIFTY ROTATING HOURS SAVED in the well using the polymer-treated mud compared to the well without the polymer. Laboratory tests with small bits bear out this comparison. Reason is that polymer-treated muds have fewer solids. Fig. 6.



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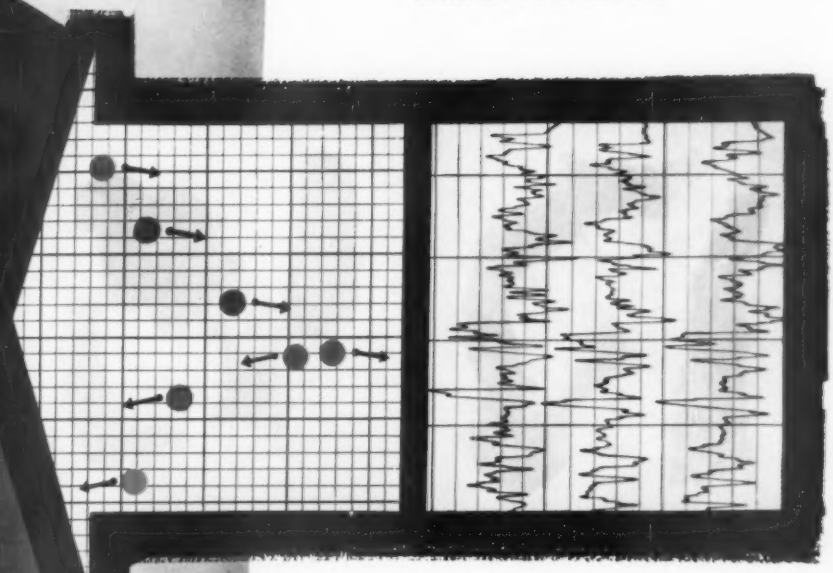

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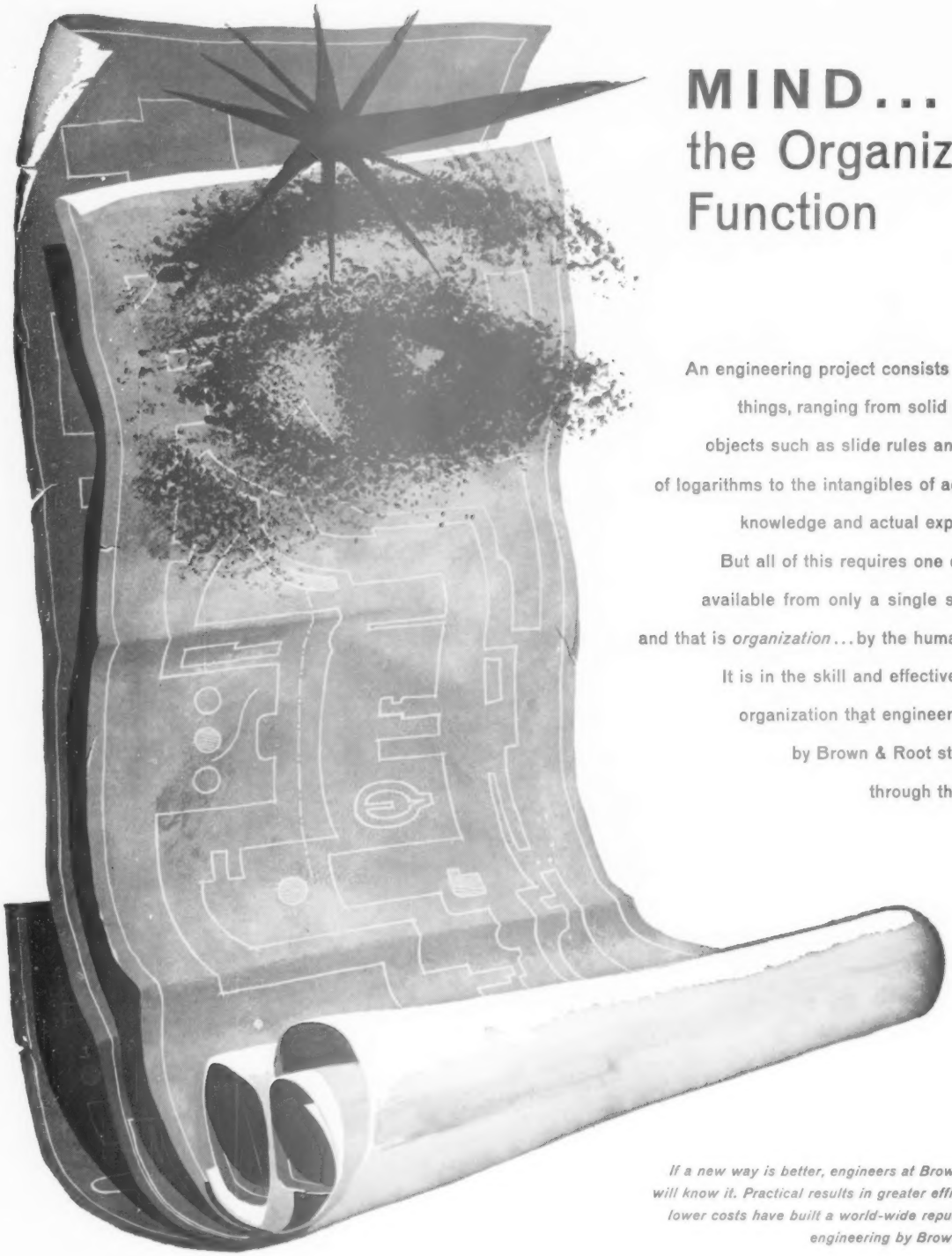

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The first common use of gas turbines in the refining industry was to drive air compressors supplying regeneration air to Houdry fixed-bed cat crackers. Now refiners are taking a second look. The economic use of waste fuel is a powerful incentive. Here's . . .

How refiners battled operating problems on early gas turbines

SMALL HOLES were drilled at each step in the combustor basket after heavy carbon deposits were found on the burner air baffles. The holes helped to increase secondary air and improve combustion. Fig. 1.

FOUR IDENTICAL 3,000-hp. gas turbines were installed several years ago by Standard-Vacuum Oil Co. to drive the main air blowers and gas compressors on fluid catalytic cracking units at two Asian refineries.

These turbines were newly designed and untested models. One was located in Wakayama, Japan; the other in Palembang, Sumatra.

Although there was considerable difficulty at first, the bugs have been worked out, and the company is looking forward to an extended period of trouble-free operation.

John Edward Cook, Standard-Vacuum Oil Co., in a paper presented to an ASME meeting in Houston, March 6-9, outlined the company's experience with these turbines. He described the major field problems encountered and modifications that were necessary to put the units into commercial operation.

KINGSBURY thrust-bearing collar shows result of intense heat generated when lubricating oil failed. Fig. 2.

ALMOST ALL turbine diaphragm blades had cracked because of sulfur in the fuel gas. Fig. 3.

The troubles:

. . . **Severe blade damage** because of sulfur in the fuel gas.

. . . **Carbon deposits** on burner nozzles.

. . . **Thrust-bearing failure** caused by loss of lubricating oil.

. . . **Power loss** caused by high ambient temperature and fouling of the axial compressor blades.

Gas-turbine blades operate in a hot gas atmosphere of 1,350° F. at 8,600 r.p.m. This, plus various transient stresses, causes blades to work very near, and occasionally beyond, their fatigue limits. Therefore any impurities in the fuel-gas stream which react with the metal alloy will inevitably damage the blade.

These particular turbines were designed to burn a fuel gas that had a maximum H_2S content of 3.6 wt. %. The refinery in which they were installed was running sour crude and H_2S content of the fuel gas was usually about 4.5 wt. %. Occasionally it exceeded 6 to 8%.

When the turbines were first shut down after about 7 months of continuous operation, inspection showed that practically all of the blades in the first two stages, both rotating and stationary, had cracked about midway of the blade length on the trailing edge. (Fig. 3).

Laboratory examination revealed the following:

1. Cracking was caused by high-temperature sulfur corrosion.

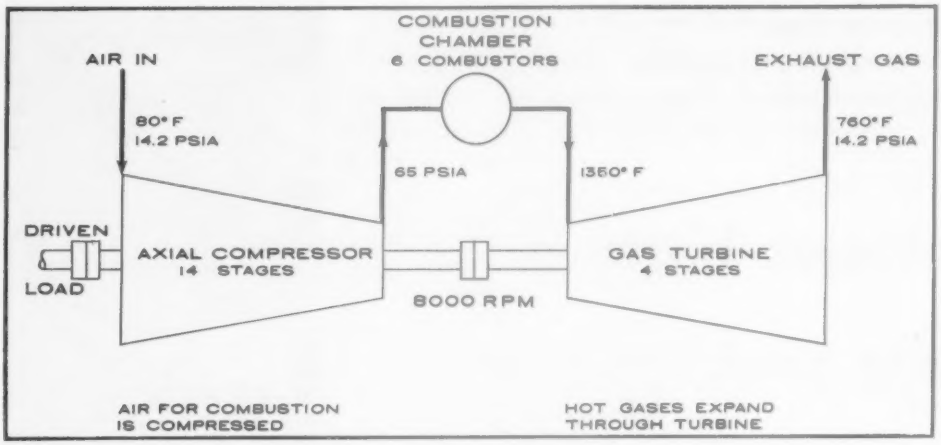
2. To prevent similar failures only low-sulfur gas should be used.

Indications are that sulfur content of combustion gas, after dilution with air, should not exceed about 40 grains per hundred cubic feet at temperatures between 1,200-1,400° F.

During the shutdown some of the damaged blades were ground for reuse. In other cases they were replaced with new ones. Desulfurization equipment was then installed to eliminate sulfur in the fuel gas.

At the next general inspection 8 months later there was no evidence of cracking on the reworked blades. However, hairline cracks were discovered in 13 of the new blades, although the turbines had been burning sulfur-free fuel during this time.

Apparently sulfurous fuel contributes to corrosion, but it's not the whole story. The problem remains a subject for research. It's reported that the manufacturer is cutting 3/16 in.



FLOW DIAGRAM for simple-cycle gas turbine indicates pressure and temperature at significant points. Fig. 4.

from the trailing edge of blades in the first two stages on all future deliveries for this machine. They say that this will reduce engine efficiency about 0.1%, but that reduced maintenance costs will justify this loss.

Carbon deposits. Experience shows that combustor design is sensitive to the heating valve of fuel. During several runs before and after startup at the Japanese plant, there were heavy carbon deposits on the burner air baffles. Laboratory tests showed that these deposits were caused by using the fuel that had an appreciably higher heating value than that called for in the design specification.

The condition was corrected by drilling more holes in the combustor basket to increase the amount of secondary air. (Fig. 1).

There was also trouble with carbon deposits in the Palembang machines. But in this case some of the holes in the primary-air baffle plates were welded closed to reduce the amount of primary combustion air.

Subsequently the combustors were redesigned and replaced by the manufacturer.

Thrust-bearing failure. Within a few days after startup following a turnaround in Japan, the gas-compressor driver dropped out of service under load. The Kingsbury thrust bearing had failed for lack of lubrication. (Fig. 2).

A partial, rather than complete, cutoff of lubricating oil was indicated by the temperature record. It showed a steadily rising oil temperature for about 15 minutes which was sustained for about an hour before the bearing failed.

The reason: Much of the 3-in. and 1-in. oil-circulation system was of welded construction, and a piece of welding slag probably lodged in a recess in a flanged coupling. When vibration of the machine dislodged the fragment, it was carried to a ⅜-in. orifice plate at the thrust-bearing inlet nipple where it may have obstructed oil flow to the bearing.

The original installation included a single temperature printer-type recorder having a range of 0-1,100° F. Nine temperatures were recorded on this chart. Five of these points recorded lubricating-oil stream temperatures between 105 and 106° F., making temperature readings on the low side of the chart illegible.

To correct this problem a low-range (0-300° F.) recorder for lubricating-oil temperatures only was installed. In addition, thermowells were installed to measure bearing-metal temperature. These are recorded on the same chart with the oil temperature.

This accident also emphasized the need for intensive operator training, especially on prototype equipment. An alert and experienced operator would have sensed the importance of this particular lube-oil temperature change.

Power losses. Gas-turbine performance is sensitive to temperature despite the fact that about 60 times the amount of air required for combustion is drawn through the machine. A power loss of about ½% per ° F., above 80° F., can be expected when operating above designed air inlet temperature.

Performance is equally sensitive to axial-compressor fouling caused by foreign material accumulating on both the stationary and rotating blades. Load capacity drops 3 to 5% for every 1-lb. drop in discharge pressure.

For instance, at one time, the Wakayama refinery was burning a high-molecular-weight fuel gas which was above design specifications. This took extra power. In addition the plant was hampered by power losses caused by both a 100° F. heat wave and by compressor fouling.

These conditions combined to force operators to cut throughput for lack of gas-compression power. Had it not been for high temperatures plus compressor fouling, the turbine would have been able to meet the load demand.

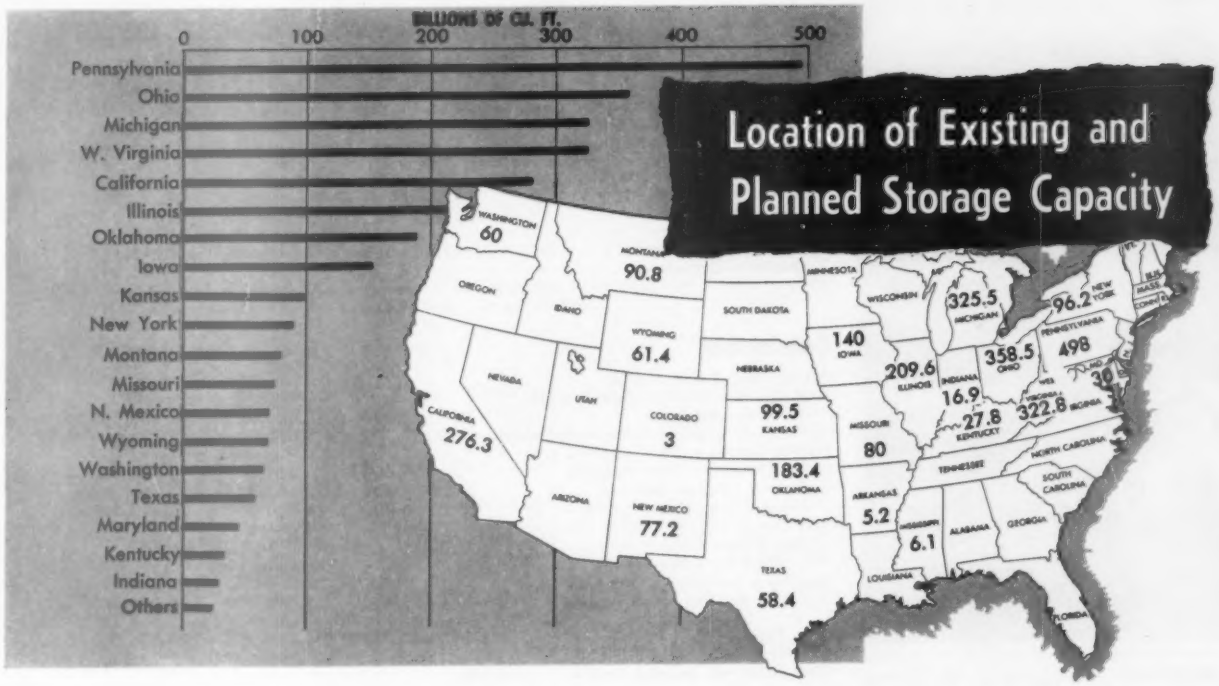
The company now feels that turbines should be designed for about 15 to 20% excess capacity over maximum load requirements. This would permit a reasonable amount of compressor fouling and seasonal rise in temperature without cutting the load. This added capacity should be accepted as a fouling factor, as it is in the case of a heat exchanger.

In lieu of this, however, methods have been devised to combat the situation.

Inlet air temperature can be lowered by installing air washers. Here effective water baffles should be insured. And the use of treated boiling water is essential.

To clean compressor blades, the scouring action of 200-mesh spent catalyst has been effective. The degree of fouling can be determined by noting the loss of discharge pressure on the axial compressor. On these machines when pressure drops from the usual 50 psig. to 46 psig., representing a shaft output power loss of about 500 hp., catalyst is hand fed into the air-intake stream at the rate of 3 lb. per minute for 15 minutes. Almost complete cleaning is effected within the first 5 minutes of catalyst injection.

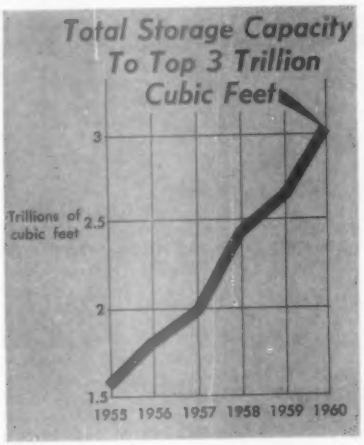
"To clean compressor blades, the scouring action of 200-mesh spent catalyst has been effective."



Natural-gas-storage capacity jumps 12%

- Industry now has 217 existing or planned storage areas in 22 states to take care of winter demand. More than 25 construction projects are under way, testing, or proposed.

BY ROBERT B. BIZAL
Director, Editorial Research



DEVELOPMENT of new underground storage capacity is keeping pace with the continuing growth of the natural-gas industry.

Total storage capacity in the U. S. will climb to more than 3.03 trillion cubic feet when the projects now under way or planned are completed.

This is a big increase of 12.2% over last year's figure of 2.7 trillion cubic feet, according to the Journal's sixth annual survey on underground-storage capacity.

The 3.03 trillion cubic feet is total reservoir capacity. This breaks down into an estimated 1.59 trillion cubic feet of working-gas capacity and about 1.44 trillion cubic feet required as cushion gas.

The new Journal survey shows more than 25 projects now under way, in the testing stage, or planned, with Illinois leading all other states in the number of new projects.

But the expansion is not confined to the heavily populated Midwest and eastern states. Colorado has entered the picture for the first time, and California will have one of the largest storage areas in the nation near San Francisco in 1962.

The 217 existing or planned storage areas were reported by 58 companies and are scattered throughout 22 states, with about half the nation's total capacity concentrated in four states—Pennsylvania, Ohio, Michigan, and West Virginia.

Why the Boom

This rapid growth of underground storage capacity is not a new thing.

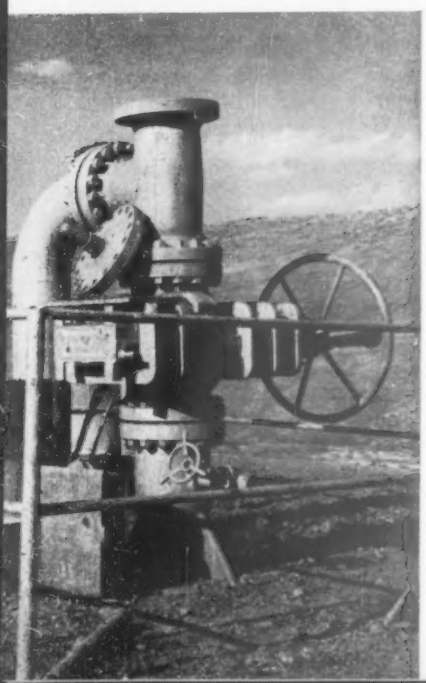
Capacity has been climbing steadily in recent years, in fact has nearly doubled in only 5 short years. In 1955, the nation's natural-gas storage capacity totaled only 1.6 trillion cubic feet.

This new storage capacity away from the big producing areas is conveniently located near the heavily populated areas. It helps companies meet winter demand and stabilizes year-round load factors for some pipelines.

Most of the storage is in depleted gas sands or aquifers, but this year for the first time one company, Public Service Co. of Colorado, is experimenting with storage in an abandoned coal mine.

(Continued on page 91)

OBJECTIVE of this 20-in. bit is the abandoned Leyden coal mine northwest of Denver. Public Service Co. of Colorado is testing the mine for storage of natural gas for use during peak winter demand days. Tests involve gas injection through the 10-in. valve pictured below. During nearly 50 years of operation, about 150,000,000 cu. ft. of coal was removed from the mine, leaving a cavern large enough to store 3,000,000 M.c.f. of gas at 300 psig. This is a unique operation. Most such storage is in gas sands or aquifers. Cost of completely developing the Leyden mine for storage is estimated at more than $5 million.



A nationwide look at under-

Arkansas

Company Field or area — County	Working-gas capacity	Required as cushion gas	Total capacity of reservoir
	All figures are in M.c.f.		
Arkansas Western Gas Co.			
Carrollton Dome—Boone (experimental)	.....	.....	.....
Stephens Production Co.			
Lavaca—Sebastian	1,004,550	3,013,624	4,018,174
Shibley—Crawford	419,920	766,327	1,186,247
Total	1,424,470	3,779,951	5,204,421

California

Pacific Gas & Electric Co.			
McDonald Island—San Joaquin (under way)	*124,500,000	54,000,000	178,500,000
Pleasant Creek—Yolo (under way)	3,250,000	5,078,500	8,328,500
Pacific Lighting Gas Supply Co.			
East Whittier—Los Angeles	800,000	425,000	1,225,000
Goleta—Santa Barbara	12,500,000	32,181,544	44,681,544
Montebello—Los Angeles	12,500,000	26,000,000	38,500,000
San Diego Gas & Electric Co.			
San Diego County (high-pressure pipe)	16,938	1,549	18,487
Southern California Gas Co.			
Playa del Rey—Los Angeles	4,000,000	1,000,000	5,000,000
Total	157,566,938	118,686,593	276,253,531

*This will include 30,000,000 M.c.f. proposed storage capacity and 94,500,000 M.c.f. of unused reservoir capacity.

Colorado

Public Service Co. of Colorado			
Leyden coal mine—Jefferson (testing)	2,000,000	1,000,000	3,000,000

Illinois

Illinois Power Co.			
Freeburg—St. Clair	1,810,000	4,590,000	6,400,000
Gillespie—Macoupin	31,000	115,000	146,000
North Tilden—Washington and St. Clair (planned)	.....	.....	.....
Mississippi River Fuel Corp.			
St. Jacob (proposed)	.....	.....	32,000,000
Waterloo—Monroe (experimental)	150,000	.....	.....
Natural Gas Storage of Illinois			
Cooks Mills—Coles	901,264	993,736	1,895,000
Herscher, Galesville—Kankakee	45,000,000	45,000,000	90,000,000
Herscher, Mt. Simon—Kankakee (under way)	39,000,000	28,000,000	67,000,000
Northern Illinois Gas Co.			
Troy Grove—LaSalle*	6,000,000	6,000,000	12,000,000
Various counties in northern Illinois (high-pressure pipe)	.....	.....	184,700
Panhandle Eastern Pipe Line Co.			
Waverly project (experimental)	.....	.....	.....
Total	92,892,264	84,698,736	209,625,700

*To be placed in operation fall 1960. Totals downgraded to reflect initial capacities.

Indiana

Central Indiana Gas Co.			
Randolph County (planned)	.....	.....	.....
Citizens Gas & Coke Utility			
Howesville—Greene	2,000,000	2,000,000	4,000,000
Indiana Gas & Water Co.			
Greensburg—Decatur	400,000	600,000	1,000,000
Unionville—Monroe	1,500,000	1,000,000	2,500,000
Westpoint—Tippecanoe	250,000	350,000	600,000
Southern Indiana Gas & Electric Co.			
Oliver—Posey	1,048,500	1,851,500	2,900,000
Texas Gas Transmission Corp.			
Alford—Pike	969,300	1,500,000	2,469,300
Leesville—Lawrence (experimental)	.....	.....	.....
Oaktown—Knox	610,710	420,490	1,031,200
Wilfred—Sullivan	1,200,000	1,200,000	2,400,000
Total	7,978,510	8,921,990	16,900,500

ground gas-storage capacity

Iowa

Company Field or area — County	Working-gas capacity	Required as cushion gas	Total capacity of reservoir
	All figures are in M.c.f.		
Northern Natural Gas Co.			
Redfield—Dallas (ultimate planned for St. Peter reservoir)	15,000,000	25,000,000	40,000,000
Redfield—Dallas (estimated ultimate for Mt. Simon reservoir)*	30,000,000	70,000,000	100,000,000
Total	45,000,000	95,000,000	140,000,000

*Being operated on a testing permit issued by FPC.

Kansas

Cities Service Gas Co.			
Alden—Rice (planned)	5,000,000	10,857,469	15,857,469
Boyer—Butler	392,279	627,588	1,019,867
Colony—Anderson	4,148,104	5,055,561	9,203,665
Craig—Johnson	1,557,945	4,517,875	6,075,820
Elk City—Montgomery and Elk	4,500,000	15,500,000	20,000,000
McLouth—Jefferson and Leavenworth	5,212,337	7,701,420	12,913,757
North Welda—Anderson	4,521,464	5,500,000	10,021,646
Piqua—Allen and Woodson	1,551,042	1,679,430	3,230,472
South Welda—Anderson	5,313,617	6,475,569	11,789,186
Consolidated Gas Utilities Corp.			
Collinson—Cowley	674,270	425,730	1,100,000
Union Gas System, Inc.			
Five fields in Wilson, Montgomery, and Chautauqua counties	2,524,175	4,130,583	8,250,000
Total	35,395,415	62,471,225	99,461,882

Kentucky

Kentucky Gas Transmission Corp.			
Menifee—Menifee, Powell	1,100,000	6,942,480	8,042,480
Louisville Gas & Electric Co.			
Doe Run—Meade, Ky., and Harrison, Ind.	2,800,000	1,200,000	4,000,000
Magnolia—Hart, Green, and Larue	2,500,000	1,000,000	3,500,000
Muldraugh—Meade	2,250,000	200,000	2,450,000
Texas Gas Transmission Corp.			
Dixie—Henderson	2,524,500	4,590,000	7,114,500
Grandview—Daviess	260,480	352,000	612,480
Hickory—Daviess	490,020	590,980	1,000,000
Western Kentucky Gas Co.			
Judge Chapel—Christian (planned)	.....	.....	520,000
Kirkwood Springs—Hopkins	225,000	300,000	525,000
Owensboro—Daviess	31,000	25,000	56,000
Total	12,181,000	15,200,460	27,820,460

Maryland

Washington Gas Light Co.			
Brandywine—Prince Georges (planned)	.....	.....	30,000,000

Michigan

Michigan Consolidated Gas Co.			
Austin—Mecosta	7,600,000	10,319,200	17,919,200
Goodwell—Newaygo	10,900,000	8,922,208	19,822,208
Lincoln-Freeman—Clare	14,700,000	9,577,849	24,277,849
Reed City—Osceola	11,300,000	10,587,100	21,887,100
Six Lakes—Mecosta and Montcalm	53,300,000	14,020,614	67,320,614
Michigan Gas Storage Co.			
Cranberry Lake—Clare	8,275,710	19,624,050	27,909,760
Overisel—Allegan	20,000,000	47,000,000	67,000,000
Riverside—Missaukee	3,132,530	7,419,150	10,551,680
Winterfield—Clare	20,425,000	48,375,000	68,800,000
Total	149,643,240	175,845,171	325,488,411

Mississippi

Mississippi Valley Gas Co.			
Amory—Monroe	781,874	318,126	1,100,656
United Gas Pipe Line Co.			
Jackson—Rankin and Hinds	4,100,000	900,000	5,000,000
Total	4,881,874	1,218,126	6,100,656

(Continued)

Reprints Available

This is the Journal's sixth annual survey on natural-gas underground storage, showing capacities of companies and by states. Reprints of this up-to-date listing are available at 50 cents per copy by addressing Reader Service, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

Chances are good that storage development will continue its fast pace. American Gas Association expects total gas sales to hit 162 billion therms in 1970, compared with actual sales of 80.3 billion therms in 1958 (OGJ, Nov. 9, 1959, p. 105).

The industry is expected to serve more than 44 million customers by the end of 1970, AGA says. This compares with about 32 million in 1959.

Who's Building

Here is a rundown of new projects currently under way, testing, or planned:

... **Arkansas Western Gas Co.** is experimenting with storage in aquifer at Carrollton Dome in Boone County, Arkansas. About 500,000 M.c.f. is now in storage, and trial withdrawals of small amounts have been successful.

... **Atlantic Seaboard Corp.** has received temporary FPC approval for new storage at Terra Alta in Preston County, West Virginia. Estimated cost of construction of the storage and allied facilities will be more than $25 million.

... **Cities Service Gas Co.,** with eight existing storages in Kansas, is planning another at Alden field, Rice County, with final development scheduled for completion in 1961. Total reservoir capacity will be more than 15,800,000 M.c.f., with working-gas capacity of 5,000,000 M.c.f.

... **East Ohio Gas Co.** is under way on a 140-well drilling program at its big Stark-Summit storage area in Ohio. Completion of the drilling program is set for 1963.

... **Equitable Gas Co.** is expected to complete construction work at Rhodes pool, Lewis County, West Virginia, sometime in 1961. When com-

pletely repressured the pool will have total storage capacity of about 10,000,000 M.c.f.

The company is also considering storage in two other fields, Rennerdale in Allegheny County, and Brooks-Meeks in Greene County, both in Pennsylvania. The two fields are being held for future use, but target dates have not been set.

... **Illinois Power Co.,** which has two existing storage areas in Illinois, plans a third one at North Tilden in Washington and St. Clair counties. Completion is scheduled in September 1961.

... **Laclede Gas Co.** is now drilling shallow test holes for its Columbia storage project in Boone County, Missouri. When completed, it will have total reservoir capacity of 40,000,000 M.c.f.

... **Michigan Gas Storage Co.** has just recently converted the Overisel field in Allegany County, Michigan, to storage, with total reservoir capacity of 67,000,000 M.c.f. and working-gas capacity of 20,000,000 M.c.f.

... **Mississippi River Fuel Corp.** hopes to start test injections this summer at St. Jacob, Ill. In its FPC application, the company estimated the storage area, to be developed for $7,800,000, would hold about 32,000,000 M.c.f.

... **Natural Gas Storage Co. of Illinois,** a subsidiary of Peoples Gas Light & Coke Co., is currently developing the Mount Simon formation at its Herscher storage area in Kankakee County, Illinois. It will hold 67,000,000 M.c.f. of which 39,000,000 M.c.f. will be working-gas capacity. This is in addition to storage in the Galesville formation at Kankakee, which has total reservoir capacity of 90,000,000 M.c.f.

... **New York State Natural Gas Corp.'s** big Leidy project in North Central Pennsylvania is now in use. Operated by New York State, it is owned jointly with Texas Eastern Transmission Corp. and Transcontinental Gas Pipe Line Corp.

Transco began deliveries in 1959, and Texas Eastern is currently awaiting FPC approval for development of its portion of the storage area. Ultimate total reservoir capacity of the area will be more than 105,000,000 M.c.f.

... **Northern Illinois Gas Co.'s** Troy Grove project in La Salle County will be placed in operation in the fall of 1960. Total reservoir capacity is 12,000,000 M.c.f., of which half is working gas. This project will hold a supply capable of serving 50,000 to 100,000 homes during the winter.

... **Northern Natural Gas Co.'s** St. Peter reservoir at Redfield, Iowa, will

A nationwide look at underground

Missouri

Company Field or area — County	Working-gas capacity	Required as cushion gas	Total capacity of reservoir
	All figures are in M.c.f.		
Laclede Gas Co.			
Columbia—Boone (testing)			40,000,000
Florissant—St. Louis	20,000,000	20,000,000	40,000,000
Total			80,000,000

Montana

Montana-Dakota Utilities Co.			
Baker—Fallon	64,082,000	16,018,000	80,100,000
Montana Power Co.			
Box Elder—Hill	397,000	2,043,000	2,440,000
Madison aquifer—Gallatin	1,000,000	5,000,000	6,000,000
Shelby—Toole	279,000	2,021,000	2,300,000
Total	65,758,000	25,082,000	90,840,000

New Mexico

El Paso Natural Gas Co.			
Rhodes—Lea	35,000,000	17,400,000	52,400,000
Southern Union Gas Co.			
Barker Dakota—San Juan	8,404,135	11,480,000	19,884,135
Keyes—Eddy	875,183	930,000	1,805,183
Vandagriff—Eddy	630,682	2,480,000	3,110,682
Total	44,910,000	32,290,000	77,200,000

New York

Home Gas Co.			
Dundee—Schuyler, Steuben, and Yates	4,300,000	6,000,000	10,300,000
Gilbert—Allegany	225,000	325,000	550,000
Greenwood—Steuben	950,000	850,000	1,800,000
Iroquois Gas Corp.			
Bennington—Wyoming	2,500,000	1,500,000	4,000,000
Collins—Erie	1,600,000	1,000,000	2,600,000
Derby—Erie	200,000		200,000
Holland—Erie	1,200,000	1,000,000	2,200,000
Lawtons—Erie	1,100,000	1,000,000	2,100,000
Nashville—Erie, Chautauqua, and Cattaraugus	4,400,000	3,600,000	8,000,000
Sheridan—Chautauqua	1,000,000	1,000,000	2,000,000
Zoar—Erie	1,000,000	1,000,000	2,000,000
New York State Natural Gas Corp.			
Woodhull—Steuben	21,120,000	14,080,000	35,200,000
Sylvania Corp.			
Tuscarora—Steuben	2,700,000	2,500,000	5,200,000
Tennessee Gas Pipeline Co. and Iroquois			
Colden—Erie	10,000,000	10,000,000	20,000,000
Total	52,385,000	43,855,000	96,150,000

Ohio

East Ohio Gas Co.			
Chippewa—Wayne	4,117,623	4,117,623	8,235,247
Columbiana—Columbiana	1,524,900	1,524,900	3,049,800
Stark-Summit—Stark and Summit	59,032,373	59,032,373	118,064,746
Manufacturers Light & Heat Co.			
Brinker—Columbiana	3,300,000	3,700,000	7,000,000
Ohio Fuel Gas Co.*			
Benton—Hocking			39,000,000
Guernsey—Guernsey and Coshocton			5,500,000
Holmes—Holmes and Wayne			24,500,000
Knox—Knox			3,700,000
Lima—Mahoning (being depleted)			
McArther—Vinton			10,500,000
Medina—Medina			8,500,000
Pavonia—Ashland			38,000,000
Weaver—Ashland and Richland			71,000,000
Wellington—Lorain and Medina			21,400,000
Zane—Muskingum			80,000
Total			358,529,793

*Working and cushion gas figures not reported by Ohio Fuel Gas.

gas-storage capacity (continued)

Oklahoma

Company Field or area — County	Working-gas capacity	Required as cushion gas	Total capacity of reservoir
	All figures are in M.c.f.		
Consolidated Gas Utilities Corp.			
Ulan—Pittsburg	7,495,174	6,004,826	13,500,000
Oklahoma Natural Gas Co.			
Depew—Creek	19,600,000	37,400,000	57,000,000
Haskell—Muskogee	2,500,000	8,400,000	10,900,000
Osage—Osage	830,000	1,900,000	2,730,000
Sayre—Beckham	63,500,000	25,800,000	89,300,000
Southwest Natural Gas Co.			
North Ada—Pontotoc	6,000,000	4,000,000	10,000,000
Total	99,925,174	83,504,826	183,430,000

Pennsylvania

Equitable Gas Co.			
Seven pools in Allegheny, Washington, and Greene counties	15,336,000	4,974,000	20,310,000
Manufacturers Light & Heat Co.			
Cross Creek—Washington (being depleted)	125,000	900,000	1,025,000
Donegal—Washington	3,400,000	4,000,000	7,400,000
Heard—Greene, Washington	3,500,000	5,800,000	9,300,000
Holbrook—Greene	700,000	500,000	1,200,000
Iowa—Jefferson	125,000	175,000	300,000
Irwin—Westmoreland	25,000	325,000	350,000
Majorsville—Greene and Washington, Pa., and Marshall, W. Va.	10,500,000	19,500,000	30,000,000
Munderf—Jefferson	50,000	.....	50,000
New York State Natural Gas Corp.			
Sabinsville—Tioga	15,450,000	18,000,000	33,450,000
Sharon—Potter	1,900,000	4,200,000	6,100,000
South Bend—Armstrong and Indiana counties	6,600,000	10,500,000	17,100,000
Tioga—Tioga	8,000,000	14,000,000	22,000,000
New York State Natural Gas and Tennessee Gas			
Ellisburg—Potter (under consideration)	.....	.....	.....
Harrison—Potter, Pa., and Steuben, N. Y.	19,680,000	13,120,000	32,800,000
New York State Natural Gas and Texas Eastern			
Oakford—Westmoreland	60,000,000	50,758,000	110,758,000
New York State Natural Gas, Texas Eastern, and Transcontinental Gas Pipe Line Corp.			
Leidy—Clinton and Potter*	60,000,000	45,650,000	105,650,000
North Penn Gas Co.			
Farmington—Tioga	8,200,000	1,800,000	10,000,000
Meeker—Tioga	4,800,000	200,000	5,000,000
Pennsylvania Gas Co.			
Total for nine fields	10,250,000	7,300,000	17,550,000
Peoples Natural Gas Co.			
Colvin—Washington	800,000	1,500,000	2,300,000
Gamble-Hayden—Allegheny	1,100,000	1,200,000	2,300,000
Mt. Royal—Allegheny	225,000	275,000	500,000
Murrysville—Allegheny	1,500,000	1,600,000	3,100,000
Patton—Westmoreland	75,000	75,000	150,000
Truittsburg—Clarion	2,100,000	1,500,000	3,600,000
Webster—Westmoreland	540,000	600,000	1,140,000
United Natural Gas Co.			
Ten fields in eight counties	4,170,000	4,600,000	8,770,000
United Natural and Pennsylvania Gas Co.			
Keeler—McKeant	600,000	1,200,000	1,800,000
United Natural and Tennessee Gas			
Hebron—Potter	22,500,000	23,800,000	46,300,000
Total	262,251,000	238,052,000	498,003,000

*Transco now using facilities. Development of the Texas Eastern portion is awaiting FPC approval. †Figures represent only United Natural's capacities. Pennsylvania Gas figures from this storage are included in that company's listing for nine fields.

(Continued)

ultimately hold an estimated 40,000,000 M.c.f. of which 70% has been reached. The Mount Simon reservoir at Redfield is being operated on a testing permit from FPC. About 25% of the 100,000,000 M.c.f. ultimate capacity has been reached.

Northern Natural estimates that the total deliverability from the Redfield reservoirs will be 300,000 M.c.f. daily on completion of development.

... **Pacific Gas & Electric Co.** is developing two new storage areas north and east of San Francisco. The McDonald Island project in San Joaquin County will be one of the nation's largest. Scheduled for completion early in 1962, it will have reservoir capacity of 178,500,000 M.c.f., including 54,000,000 cushion gas, 30,000,000 storage capacity, and 94,500,000 unused reservoir capacity.

The company's Pleasant Creek project in Yolo County will have total reservoir capacity of more than 8,300,000 M.c.f. when completed early in 1962. These will be the first storage fields in PG&E's system.

... **Public Service Co. of Colorado** is testing storage possibility in a unique operation near Denver. The abandoned Leyden coal mine in Jefferson County would be used to store 3,000,000 M.c.f.

... **Union Hill Gas Storage Co.**, a subsidiary of Peoples Gas Light & Coke Co., is exploring possibility of storing gas near the town of Mahomet in Champaign County, Illinois. Drilling of test wells has indicated dome-shaped underlying rock formations suitable for gas storage.

... **Washington Gas Light Co.** still hasn't received the go-ahead to develop a 30,000,000-M.c.f. project at Brandywine, Md. A bill introduced last year in the Maryland legislature, which would have given the company right of eminent domain, was tabled. A similar bill will not be eligible for reconsideration until the 1961 legislature convenes.

The status of several other planned storage projects remain unchanged from last year, according to the responses to the new Journal survey.

They include projects for storage by Central Indiana Gas Co. in Randolph County, Indiana; Mississippi River Fuel at Waterloo, Ill.; New York State Natural Gas Corp. and Tennessee Gas Pipeline Co. in Potter County, Pennsylvania; Panhandle Eastern Pipe Line Co. at Waverly, Ill.; Pleasant Valley Gas & Oil Co. in Lewis County, Washington; Texas Gas Transmission Corp. at Leesville, Ind.; and Western Kentucky Gas Co. in Christian County, Kentucky.

The status of two projects listed as under way in last year's survey remains the same. They are Texas Gas

Underground gas-storage capacity (Cont'd.)

Texas

Company Field or area — County	Working-gas capacity	Required as cushion gas	Total capacity of reservoir
	All figures are in M.c.f.		
Houston Pipe Line Co.			
Bammel—Harris (option at cycling project)	.....	.....	2,000,000
Lone Star Gas Co.			
Ambassador—Clay	750,000	841,920	1,591,000
Leeray—Stephens	5,000,000	2,080,000	7,080,000
New York City pool—Clay	4,688,017	1,711,840	6,399,857
Tri-Cities—Henderson	23,667,298	8,447,900	32,115,198
View—Taylor	2,370,000	1,130,000	3,500,000
Southwest Natural Gas Co.			
Chapman—Comanche	100,000	100,000	200,000
Lester—Comanche	3,500,000	2,000,000	5,500,000
Total	40,075,315	16,311,660	58,386,055

Washington

Pleasant Valley Gas & Oil Co.			
Jackson Prairie—Lewis (planned)	.....	.....	60,000,000

West Virginia

Atlantic Seaboard Corp.			
X-56—Upshur	3,000,000	6,200,000	9,200,000
Terra Alta—Preston (planned)	.....	.....	.....
Equitable Gas Co.			
Six pools in Taylor, Doddridge, Lewis, and Marion counties	10,709,000	2,096,000	12,805,000
Rhodes—Lewis (under way)	.....	.....	10,000,000
Godfrey L. Cabot, Inc.			
Fayette Land Co.—Fayette	18,000	14,000	32,000
Heizer X-1—Putnam	2,100,000	1,500,000	3,600,000
Raleigh—Raleigh	900,000	600,000	1,500,000
Hope Natural Gas Co.			
Bridgeport—Harrison and Taylor	5,000,000	4,500,000	9,500,000
Fink—Doddridge and Lewis	31,000,000	25,000,000	56,000,000
Kennedy—Harrison and Lewis	24,000,000	7,000,000	31,000,000
Newberne—Gilmer	3,500,000	1,500,000	5,000,000
Racket—Gilmer and Ritchie	2,500,000	1,500,000	4,000,000
Manufacturers Light & Heat Co.			
Victory—Marshall and Wetzel (estimated ultimate)	14,000,000	20,000,000	34,000,000
United Fuel Gas Co.			
X-1—Putnam	312,500	787,500	1,100,000
X-2—Kanawha	2,600,000	2,600,000	5,200,000
X-4—Putnam	1,800,000	2,850,000	4,650,000
X-6—Kanawha	3,100,000	3,310,000	6,410,000
X-7—Kanawha	900,000	653,000	1,553,000
X-8—Kanawha	500,000	1,260,000	1,760,000
X-15A—Putnam	850,000	985,000	1,835,000
X-15B—Kanawha	950,000	1,695,000	2,645,000
X-17—Roane	1,200,000	1,715,000	2,915,000
X-19A—Roane	1,050,000	1,610,000	2,660,000
X-19B—Roane	700,000	1,795,000	2,495,000
X-49—Putnam	1,000,000	1,350,000	2,350,000
X-52A—Kanawha	17,000,000	25,100,000	42,100,000
X-52B—Kanawha	4,000,000	5,852,000	9,852,000
X-52C—Kanawha	11,600,000	8,500,000	20,100,000
X-53—Kanawha	60,000	19,000	79,000
X-54—Kanawha	2,500,000	3,180,000	5,680,000
X-58—Wood and Wirt	4,500,000	4,300,000	8,800,000
X-59—Jackson	11,000,000	13,000,000	24,000,000
Total	162,349,500	150,471,500	322,821,000

Wyoming

Montana-Dakota Utilities Co.			
Billy Creek—Johnson	3,227,000	573,000	3,800,000
Elk Basin—Park	51,374,000	6,226,000	57,600,000
Total	54,601,000	6,799,000	61,400,000
GRAND TOTAL	*1,586,733,394	*1,439,882,015	3,026,615,409

*These two figures are estimates, based on ratios of working gas and cushion gas to total reservoir as reported in most cases.

Transmission's Wilfred project in Indiana, and Manufacturers Light & Heat Co.'s Victory project in West Virginia.

BOOKS

CORROSION DATA SURVEY, 1960 edition. Compiled by George A. Nelson, staff metallurgist, Shell Development Co. Published by Shell Development Co., Emeryville, Calif. $50.

The survey represents the latest corrosion information available from scientific literature from all parts of the world. It illustrates in a general manner the behavior of about 1,500 corrosive environments when in contact with approximately 50 constructional materials.

The book is a series of 50,000 charts with about 500,000 reference points that list process streams ranging from abietic acid to zirconium nitrate. It tells at a glance the best type of material to use for a particular stream in concentrations to 100% and temperature ranges from 75° to 800° F. for corrosion rates of less than 0.002 in. per year to over 0.05 in. per year.

The code used to illustrate the data is interesting in that the charts eliminate the figure zero. Charts usually have a 0% as the left hand margin. However, as 0% cannot exist as a concentration, the line stands idle, without data on it. By considering this line as the right hand side of the chart only and representing 100%, consecutive charts can be arranged side by side with no intervening space.

By using this method a tremendous compression of information is possible. For example, many compilations of data require at least a page (about 90 sq. in.) to describe the effects of a particular corrosive on materials. Using Nelson's method, the same amount of data needs only a total space of ½ in. wide and 14 in. long, 7 sq. in. or a compression of 12 to 1.

Since the compounds in the corrosion charts are in alphabetical order, a cross-index (a new feature of the 1960 edition) brings together chemicals of similar composition, making the information more readily available for purposes of comparison. Thus, if little or no data are available on a desired compound, the crossindex makes it possible to find a related substance.

PROCEEDINGS OF THE SYMPOSIUM ON THE DEVELOPMENT OF PETROLEUM RESOURCES OF ASIA AND THE FAR EAST. Published by Department of Public Information, United Nations, New York. 251 pp. $2.50.

This publication contains the report and the principal documents of the Symosium on the Development of Petroleum Resources of Asia and the Far East, which was held in New Delhi, India, in December 1958 under the sponsorship of the United Nations Economic Commission for Asia and the Far East.

Maps for the documents are contained in an annex, published separately for $1.

This is Part 10 of a mineral-sources development series. Part 11, Mining developments in Asia and the Far East, 1957, may be obtained for 75 cents at the same address.

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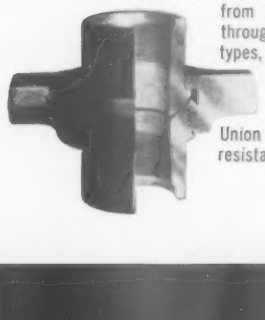

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How refiners have solved some asphalt problems

Asphalt blending plus the use of chemical modifiers will help to improve asphalt quality, but more thorough laboratory analysis of the heavier bituminous materials would give a better basis for the most likely blendings. Here are few cases of refiners with apparently the same problem who found widely varying solutions. More accurate laboratory data could help to define these seemingly identical problems more clearly.

BY C. W. BERGER
Consultant to Wainwright Producers, and Refiners, Ltd.
Edmonton, Alberta

THE EFFECTS of refining technique on asphalt quality are broad and numerous and vary considerably, depending on the crude-oil feed. The solution that will cure one refiner's problem may not work at another refinery with apparently the same trouble.

A few examples may serve to illustrate this point:

1. One refiner in the southern United States is making emulsifiable asphalt and filled pipe coating, but with poor success because of emulsion instability on the one hand and moisture permeability on the other. He installed adequated crude-oil desalting equipment and his problems disappeared.

Another refiner in the same area is making emulsified asphalts. He has good desalting equipment, and finds it necessary to add a little salt back to the asphalt.

2. A refiner manufacturing a naphtha cutback industrial "paint" found his product "livering" or increasing in viscosity upon standing. He simply held the product until it had increased in viscosity to nearly the maximum, then mixed it thoroughly again, adding a little more of the same solvent. He then shipped it as a stable product.

Another refiner with similar problems found that he had to change to naphtha produced from a different crude oil.

A third solved a similar problem by addition of a small percentage of additive while loading.

A fourth had a somewhat similar problem but it existed with or without naphtha cutback. He found that one of his crudes, normally mixed with total charge, would crack at processing temperature. An Oliensis test would not disclose this fact because that particular crude contained a percentage of natural spot-curing material. The problem was solved by planning crude-oil blending so that not over a given percentage of the guilty crude was present in any given blend.

3. One refiner was about to go out of the asphalt business because his product, from the only crude oil available to him, failed to meet ductility specifications. It showed 40 to 50 cm. and needed to be 100 cm. He found three effective answers: (1) add a small amount of polymer, (2) add a percentage of naturally highly ductile asphalt, and (3) add a combination of the two. This was less expensive than either alone.

After these immediate steps had allowed him to continue asphalt sales, he had more time to correct the basic trouble—presence of a semimicro wax cut intermediate between the asphalt flux and the heaviest vacuum gas oil.

Individual steam distributors were installed below the side-to-side pans in the flash zone of his vacuum tower and a dry deck drawoff provided for this waxy cut. After this, not only was he able to improve asphalt ductility, but he was also able to produce a valuable cut of waxy bituminous material—useful as a plasticizing stock in controlling blown asphalt specifications such as those of some of the membrane asphalts.

4. A refiner found that he could not reduce waxy flux below 1,000 penetration (it is possible to estimate penetrations in high ranges either by testing without weights other than that of the penetrometer needle and plunger, or by correlations with viscosity) after a necessary change in crude-oil charging stock. He installed a solvent-extraction system and now can go as low as zero penetration if he likes. He found that the asphalt quality from such a highly paraffin flux was very good.

Still another refiner, encountering an apparently very waxy flux, found upon vacuum reduction to penetration asphalts, that, though the vacuum gas oils were indeed waxy, penetration asphalt was aromatic and failed to pass minimum viscosity limits at high temperature for the harder grades.

However, he found at least three different methods to overcome this problem: (1) oxidize the same vacuum flux reduce to softer penetration, thus leaving in heavy fractions of paraffinic nature, (2) blend in outside flux of very high viscosity for a given penetration, and (3) add an extremely viscous polymer.

Using percentages of thermally cracked residuals to alter asphalt quality is very effective in some cases. It is used in blending both before and after vacuum reduction. Some straight-run fluxes will accept high percentages of thermal tar without displaying heterogeneity while others will accept none at all. Each case must be handled individually and with caution.

These few examples have shown a little about how variations in refining technique can affect asphalt quality even when the refiner is set upon making the best asphalt possible. Add the factors involved when the refiner considers asphalt only a necessary evil, who doesn't provide adequate equipment or technology, or who is crippled by needing to run crude oils unsuited to the purpose, and you can better understand why refining technique is important to asphalt quality.

Adapted from a paper presented to the fourth annual conference of Canadian Technical Asphalt Association, Winnipeg, Man.

23. How to compute an average-permeability-ratio curve

. . . for a lease or a reservoir, using individual sample curves

BY E. T. GUERRERO
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and
F. M. STEWART
Petroleum Engineer, Continental Illinois National Bank & Trust Co., Chicago

GIVEN: Laboratory permeability-ratio data for five curves within a permeability range and average curves for four additional ranges as shown in Tables 2 and 3, columns 1 through 6. The respective ranges represent the formation according to the percentage thickness factors given in Table 1.

TABLE 1—WEIGHTING FACTORS FOR DIFFERENT RANGES

Ranges		% of formation thickness
Number	Permeability range, md.	
1	Less than 10	15.1
2	10-50	38.5
3	50-100	32.7
4	100-300	11.3
5	300-500	2.4

FIND: 1. Average permeability-ratio curve for the five curves of range 1 by visual approximation and by the least-squares method.

2. Average reservoir (or lease) permeability-ratio curve by (a) visual approximation, (b) least-squares method, and (c) weighting according to the sand represented by each range.

METHOD OF SOLUTION: For solution by the method of least squares, this equation applies:

$$\log (k_g/k_o)' = \left[\frac{n \Sigma (S_L \log k_g/k_o) - \Sigma S_L \Sigma \log k_g/k_o}{n \Sigma S_L^2 - (\Sigma S_L)^2}\right] S_L' + \left[\frac{\Sigma S_L^2 \Sigma \log k_g/k_o - \Sigma S_L \Sigma (S_L)(\log k_g/k_o)}{n \Sigma S_L^2 - (\Sigma S_L)^2}\right] \quad (1)$$

And for the weighted average solution, this equation is used:

$$S_{Lav.} = \sum_{i=1}^{i=5} S_{Li} H_i \quad (2)$$

Where:

$(k_g/k_o)'$ is average permeability-ratio for a given saturation.

S_L' is average saturation corresponding to $(k_g/k_o)'$.

S_L is total liquid saturation.

k_g/k_o is permeability ratio.

H_i is fraction of formation thickness represented by a permeability range.

S_{Li} is range average total liquid saturation corresponding to a selected k_g/k_o.

$S_{Lav.}$ is average reservoir (or lease) total liquid saturation corresponding to a selected k_g/k_o.

SOLUTION: Table 2, columns 7 through 15, show the basic least-squares calculations for the equation of the average curve for the five graphs of range 1. With these data, Equation 1 can be solved:

$$\log (k_g/k_o)' = \left[\frac{(35)(134.7) - (2{,}640)(4.628)}{(35)(202{,}220) - (2{,}640)^2}\right] S_L' + \left[\frac{(202{,}220)(4.628) - (2{,}640)(134.7)}{(35)(202{,}220) - (2{,}640)^2}\right] = -0.06941\, S_L' + 5.368 \quad (3)$$

For $S_L' = 90\%$

$\log (k_g/k_o)' = -(0.06941)(90) + 5.368$

$= 9.121 - 10$

$(k_g/k_o)' = 0.132$

Table 3, columns 7 through 15, shows the basic least-squares calculations for the equation of the average curve for the graphs of the five ranges. Again solving Equation 1:

$$\log (k_g/k_o)' = \left[\frac{(30)(-329.2) - (2{,}190)(-2.677)}{(30)(161{,}720) - (2{,}190)^2}\right] S_L' + \left[\frac{(161{,}720)(-2.677) - (2{,}190)(-329.2)}{(30)(161{,}720) - (2{,}190)^2}\right] = 0.0723\, S_L' + 5.190 \quad (4)$$

For $S_L' = 80\%$

$\log (k_g/k_o)' = (-0.0723)(80) + 5.190$

$= 9.406 - 10$

$(k_g/k_o)' = 0.255$

Using the data for $k_g/k_o = 0.04$ in Table 4, and the weighting factors from Table 1,

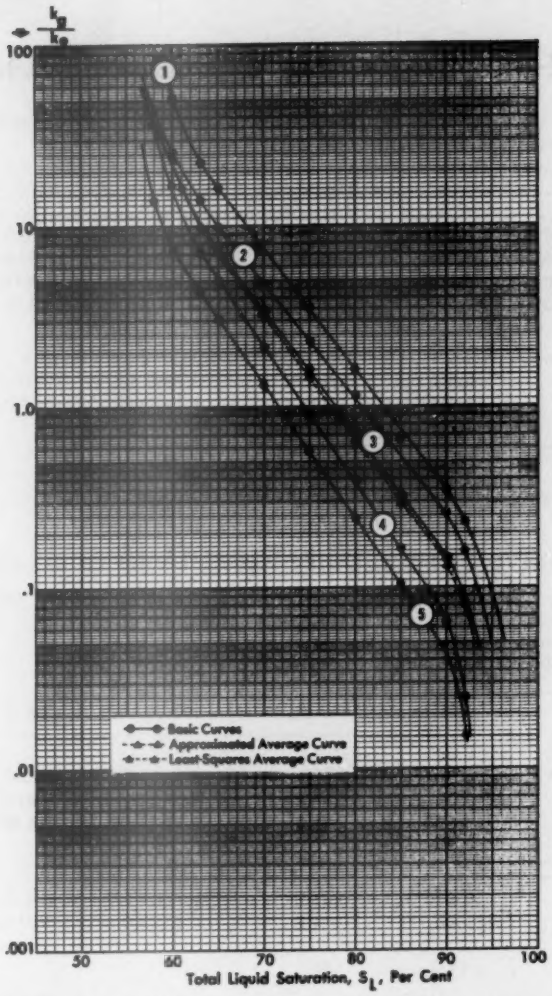
$S_{Lav.} = (93.1)(0.151)$

$+ (93.9)(0.385) + (90.6)(0.327)$

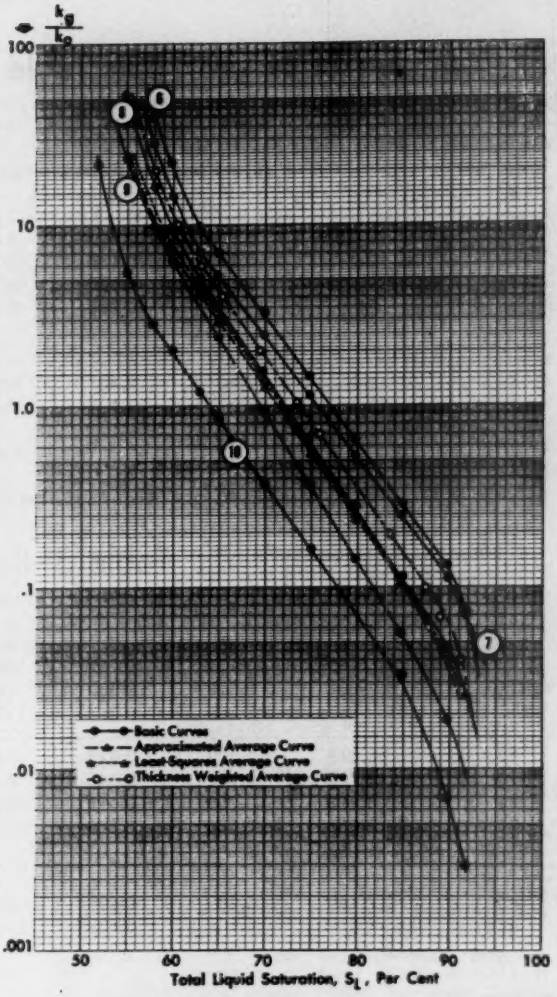
$+ (86.7)(0.113) + (83.6)(0.024)$

$= 91.6\%$

DISCUSSION: This problem essentially illustrates three methods of averaging relative-permeability-ratio curves. The approximate and least-squares methods are similar in that they give each curve equal weight. The former is performed by visual inspection and approximation; the latter method involves the solution of Equation 1. It is the equation of the straight line best fitting the data points. The slope and ordinate intercept constants



INDIVIDUAL CURVES for range 1 data and the average curves by visual inspection and least-squares approach. Difference between the last two is apparent only at high values of k_g/k_o. Fig. 1.



INDIVIDUAL AVERAGE RANGE CURVES, and the average of these determined by three different methods. The thickness weighted average curve is considered the most reliable in this case. Fig. 2.

are so determined that they make the sum of the squares of the residuals a minimum.[1] In cases similar to this problem where the ordinate variable is considered dependent on the abscissa variable the residual is defined as the difference between the ordinate of a given point and the ordinate of the corresponding point on the least-squares line.[1] In its simplest form Equation 1 can be written as

$$y = m\,x + b$$

where

$$y = \log (k_g/k_o)'$$

$$m = \frac{n \Sigma (S_L \log k_g/k_o) - \Sigma S_L \Sigma \log k_g/k_o}{n \Sigma S_L^2 - (\Sigma S_L)^2}$$

$$b = \frac{\Sigma S_L^2 \Sigma \log k_g/k_o - \Sigma S_L \Sigma (S_L \log k_g/k_o)}{n \Sigma S_L^2 - (\Sigma S_L)^2}$$

$$x = S_L'$$

Finding m and b involves writing an ordinate residual for each data point. These are squared, summed, and arranged to give quadratic equations in b and m which can be partially differentiated (with respect to m and b) and solved for b and m.

The third method used involves weighing the saturations of the various curves at a given k_g/k_o according to the fraction of sand represented by each respective curve.

There are many possible methods of averaging k_g/k_o data. It can be assumed that each section of a reservoir is in capillary equilibrium with surrounding sections. Thus capillary-pressure data can then be used to develop average saturation values from which corresponding average k_g/k_o values can be obtained. Tests conducted by Owens et al.[2] show that this method gives average curves that lie well above corresponding field average curves. The deviation was appreciable and thus this method is not recommended.[2]

Another method involves the assumption that all sections of a reservoir were depleted evenly and thus contained essentially equal saturation. This is difficult to justify because the higher-permeability sections would deplete faster than the lower-permeabil-

Table 2–Relative-Permeability Data and Least-

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Basic data							
Tot. liquid satn. %	k_g/k_o for less than 10 md. range curves							
S_L	1	2	3	4	5	$\log (k_g/k_o)_1$	$\log (k_g/k_o)_2$	$\log (k_g/k_o)_3$
92	0.230	0.160	0.078	0.025	0.017	9.362 − 10	9.204 − 10	8.893 − 10
90	0.345	0.260	0.150	0.065	0.045	9.538 − 10	9.415 − 10	9.176 − 10
85	0.650	0.550	0.330	0.168	0.108	9.814 − 10	9.740 − 10	9.519 − 10
80	1.60	1.12	0.720	0.390	0.248	0.205	0.050	9.858 − 10
65	16.3	9.70	7.40	5.00	3.00	1.213	0.987	0.870
63	22.0	14.0	10.5	7.20	4.30	1.344	1.147	1.022

$n = (7)\,(5)^* = 35$. $\Sigma \log k_g/k_o = 4.628$. $\Sigma (S_L \log k_g/k_o) = 134.7$. $\Sigma S_L = (5^*)\,(90 + 85 + 80 + 75 + 70 + 65 + 63)$

Table 3–Relative-Permeability-Ratio Data and Least-

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Average k_g/k_o for ranges							
Tot. liquid satn. %	0-10 md.	10-50 md.	50-100 md.	100-300 md.	300-500 md.			
	6	7	8	9	10	$\log (k_g/k_o)_6$	$\log (k_g/k_o)_7$	$\log (k_g/k_o)_8$
92	†0.075	0.073	0.025	0.010	0.003	.....	.....	.....
90	0.132	0.115	0.046	0.019	0.007	9.121 − 10	9.062 − 10	8.663 − 10
85	0.293	0.250	0.118	0.057	0.034	9.467 − 10	9.398 − 10	9.072 − 10
80	0.654	0.530	0.280	0.145	0.073	9.816 − 10	9.724 − 10	9.448 − 10
65	7.160	5.20	3.60	2.40	0.870	0.855	0.716	0.556
63	9.870	7.10	5.10	3.50	1.20	0.995	0.852	0.708

$n = (6)\,(5)^* = 30$. $\Sigma \log k_g/k_o = -2.677$. $\Sigma (S_L \log k_g/k_o) = -329.2$. $\Sigma S_L^2 = (32{,}344)\,(5)^* = 161{,}720$. $\Sigma S_L =$

†From extrapolated average curve.

TABLE 4—WEIGHTED AVERAGE PERMEABILITY-RATIO DATA

k_g/k_o from Fig. 2	Total liquid saturation, per cent, From Fig. 2					Thickness weighted avg.
	S_{L6}	S_{L7}	S_{L8}	S_{L9}	S_{L10}	
0.04	93.1	93.9	90.6	86.7	83.6	91.6
0.07	92.0	92.0	87.8	83.8	80.3	89.4
0.10	91.0	90.5	85.7	81.9	78.0	87.7
0.20	87.3	86.3	81.7	78.2	73.9	83.7
0.40	83.0	81.8	77.7	74.5	69.7	79.5
0.70	79.4	78.1	74.4	71.5	66.3	76.1
1.00	77.2	75.8	72.3	69.6	64.1	73.9
2.00	72.9	71.2	68.3	65.9	60.0	69.6
4.00	68.5	66.7	64.3	62.2	56.3	65.4
6.00	66.0	64.1	62.1	60.2	54.9	63.1
10.00	62.9	61.5	59.9	57.9	53.6	60.6
20.00	60.3	59.0	57.4	55.6	52.1	58.1

ity sections. In spite of this, some success has come with this method.[2]

It can be visualized that in the depletion process the tighter sections would tend to produce into the more permeable strata. This migration would continue until all the sections were producing at the same k_g/k_o but having different saturations. Or this is the same as assuming that all sections will produce at equal gas-oil ratios.[2] This principle was used in averaging the permeability range k_g/k_o curves of Fig. 2.

Note in Tables 2 and 3 that only part of the data were used in the least-squares calculations. A check of the basic curves in Figs. 1 and 2 will show that the data selected essentially represent the linear portion of the plots. This was necessary because the linear least-squares approach was used. Such an approach is sufficiently accurate since the linear portion of the graphs represents the major part of the history of a depletion-type reservoir.

Squares Calculations for Range 1

(10)	(11)	(12) $\log k_g/k_o =$ (7)+(8)+(9)+	(13) $S_L \log k_g/k_o =$	(14)	(15) $(k_g/k_o)'$
$\log (k_g/k_o)_4$	$\log (k_g/k_o)_5$	(10)+(11)	(1)×(12)	S_L^2	Eq. (3)
8.398−10	8.231−10	.....	.....	....	....
8.813−10	8.654−10	−4.404	−396.4	8,100	0.132
9.226−10	9.034−10	−2.667	−226.7	7,225	0.293
9.592−10	9.395−10	−0.900	− 72.0	5,400	0.654
0.700	0.478	4.248	276.1	4,225	7.160
0.858	0.634	5.005	315.3	3,969	9.870
		4.628	134.7	40,444	

$= 2{,}640$. $\Sigma S_L^2 = (40{,}444)(5)^* = 202{,}220$. *Five data points exist at each saturation.

Squares Calculations for All Ranges

(10)	(11)	(12)	(13)	(14)	(15)
$\log (k_g/k_o)_9$	$\log (k_g/k_o)_{10}$	$\log (k_g/k_o) =$ (7)+(8)+(9) +(10)+(11)	$S_L \log k_g/k_o =$ (1)×(12)	S_L^2	$(k_g/k_o)'$ Eq. (4)
.....	.....	.....	.....	....	....
8.279−10	7.845−10	.....	.....	....	....
8.756−10	8.532−10	−4.775	−405.9	7,225	0.111
9.162−10	8.864−10	−2.986	−238.9	6,400	0.255
0.380	9.940−10	2.447	159.1	4,225	3.085
0.544	0.080	3.179	200.3	3,969	4.315
		−2.677	−329.2	32,344	

5* (85 + 80 + 75 + 70 + 65 + 63) = 2,190. *Five data points exist at each saturation.

Fig. 1 shows the individual curves for range 1 and the average curves determined by visual inspection and the least-squares approach. The former was drawn first in order that the latter would not influence the approximation. In this particular case the approximate curve is about the same as the least-squares curve. It is well to note that the position of the approximate curve will depend to some degree on the engineer whereas the least-squares curve will be the same regardless of who computes it.

Fig. 2 shows the individual average range curves and the average of these determined by three methods. In this case a slight difference is noted between the approximate and the least-squares average curves. Still a greater difference is found between these and the thickness weighted average curve. The latter is considered the most applicable because it gives more weight to those ranges which represent the bulk of the formation. The least-squares average curve was extrapolated by visual inspection.

In comparing the approximate and least-squares methods of averaging k_g/k_o curves, it might be said that for most cases the error involved in using the former method does not justify use of the more tedious least-squares approach. However, where an electronic computer is used the least-squares method is considered practical. Of more importance than the averaging method utilized is the question of determining just how well the curves used actually represent the formation under consideration.

References

1. Richardson, C. H., "An Introduction to Statistical Analysis," Revised Edition, 1943, Harcourt, Brace & Co., pp. 210-219.

2. Owens, W. W., Parrish, D. R., and Lamoreaux, W. E., "A Comparison of Field k_g/k_o Characteristics and Laboratory k_g/k_o Test Results Measured by a Simplified Method," Transactions AIME, 1956.

This series to date

The RESERVOIR ENGINEERING series has been running continually since October 27, 1958. Here's a rundown on past installments:

1. "How to Determine Effective Porosity," October 27, 1958, p. 86.

2. "More on How to Determine Effective Porosity," November 24, 1958, p. 77.

3. "Effective Porosity from MicroLog and Microlaterolog," December 22, 1958, p. 81.

4. "Development of Neutron-Derived Porosity Curve," January 12, 1959, p. 100.

5. "Effective Porosity and Water Saturation from Electric and MicroLog Data," February 9, 1959, p. 108.

6. "How to Measure Absolute Permeability Using Linear Flow and Compressible Fluid," March 2, 1959, p. 119.

7. "Measurement of Absolute Permeability Using Radial Flow and Compressible Fluids," April 13, 1959, p. 126.

8. "Measurement of Effective Permeability Using Linear Flow and Compressible Fluids," April 20, 1959, p. 120.

9. "Measurement of Effective Permeability Using Radial Flow and Compressible Fluids," May 11, 1959, p. 92.

10. "Determination of Absolute Permeability from Well-Test Data," June 29, 1959, p. 97.

11. "How to Determine Effective Permeability from Field Data," July 13, 1959, p. 112.

12. "How to Determine Effective Permeability from Field Data in a Gas Reservoir," July 27, 1959, p. 184.

13. "How to Determine Effective Permeability from Pressure-Building Data Under Finite Boundary Conditions," August 10, 1959, p. 119.

14. "How to Determine Effective Permeability from Pressure-Buildup Data Under Finite Boundary Conditions," October 5, 1959, p. 167.

15. "How to Determine Effective Permeability from Multiphase Pressure-Buildup Data Under Finite Boundary Conditions," October 26, 1959, p. 87.

16. "How to Calculate Average Permeability of a Lease," November 9, 1959, p. 158.

17. "How to Calculate Average Porosity of a Lease," November 23, 1959, p. 101.

18. "How to Obtain a k_g/k_o Curve from Laboratory Steady-State Relative-Permeability Measurements," January 11, 1960, p. 95.

19. "How to Obtain a k_g/k_o Curve from Laboratory Unsteady-State Flow Measurements," February 1, 1960, p. 96.

20. "How to Obtain and Compare k_w/k_o Curves from Steady-State and Laboratory Unsteady-State Flow Measurements," February 22, 1960, p. 104.

21. "How to Obtain Relative Permeabilities and Relative Permeability Ratios," March 7, 1960, p. 106.

22. "How to Determine the k_g/k_o Ratio from Production and Fluid-Analysis Data," April 11, 1960, p. 116.

PRODUCTIVE CAPACITY of one of the wells producing from the 450-ft.-deep reservoir is shown here. A valve on the wellhead was accidentally knocked off, and this blowout was the result. Results of 1 year's operation are included in this report, which shows . . .

East Texas' first fire flood is

BY P. D. WHITE and J. T. MOSS
Tejas Petroleum Engineers, Dallas

These authors declare:

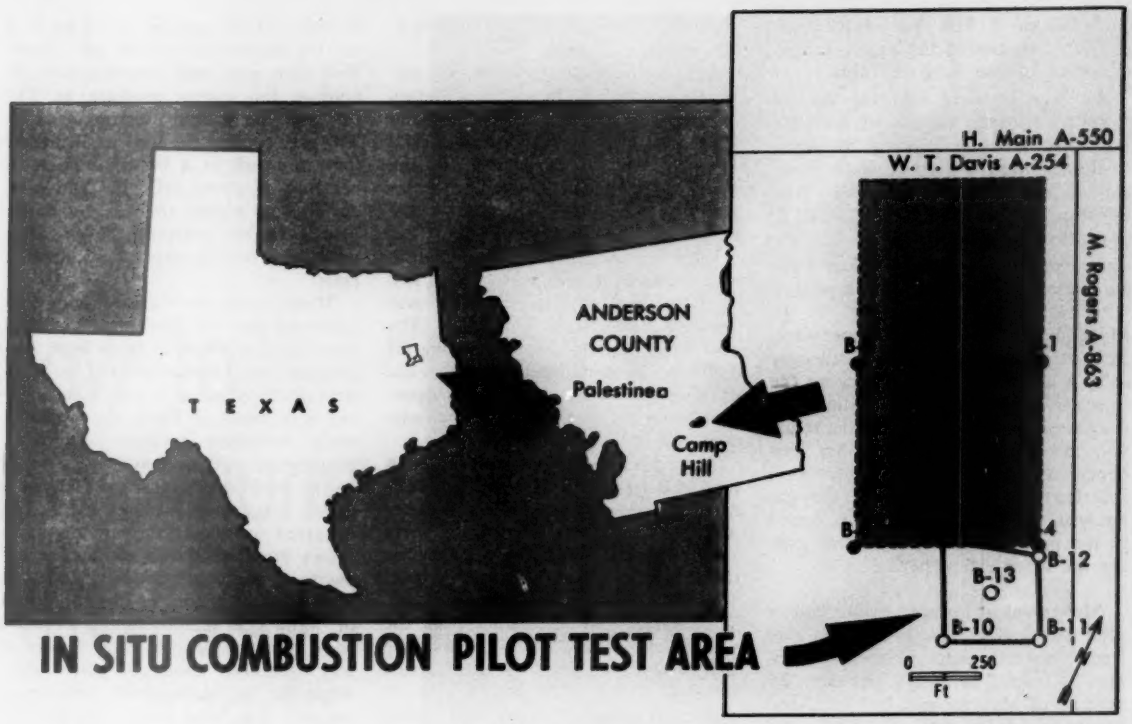
1. The Carrizo-Wilcox zone in East Texas is extremely susceptible to combustion. Efficiency in the test to date is higher than any previously reported in the literature.
2. It is possible to conduct in situ combustion operations in a reservoir having bottom water present.
3. There has been no evidence of excessive corrosion in the wells or well equipment. The heat front has been in one well for more than 10 months and the tubular goods show no indication of excessive corrosion.
4. Sand control in highly unconsolidated, fine-grained reservoirs is a genuine problem at the greatly accelerated production rates associated with the in situ combustion process. At least one method of controlling the sand has been used, and undoubtedly better methods will be found.

LOCATED about 10 miles from Palestine, Tex., near the abandoned Camp Hill field, this pilot test has at least another year of operation before completion. Some of the unusual aspects of the flood, however, warrant release of preliminary findings at this time.

History of development. The Gulf Oil Co. 1 Davey-Royall discovery well was drilled in 1935. A total of six wells were drilled to the 450-ft. Carrizo-Wilcox formation. These produced about 5 bbl. of oil per day each with a high gas-oil ratio for the first few weeks. Production declined rapidly however, and the few wells presently producing in the vicinity make less than 1 bbl. per day.

Pay thickness varies from 20 to 50 ft., and the sand appears to be well developed over several thousand acres.

Other methods tried. During the past 10 years, several attempts have been made to produce the oil in commercial quantities. Methods used include LPG injection, water flood, and



IN SITU COMBUSTION PILOT TEST AREA

successful

Data collected from this 2½-acre inverted five-spot in the shallow Carrizo-Wilcox formation will be valuable to other operators considering thermal-recovery projects of the in situ combustion type. Outlook for a commercially successful, full-scale project in the near future is very good.

hot-air drive. But only a limited degree of success was achieved.

Reasons for failure are the high oil viscosity, fine-grained, unconsolidated sand, lack of reservoir pressure, and the presence of an underlying water sand.

Ideal combustion prospect. Although there are many unsolved production problems, the area is of particular interest as an in situ combustion prospect. This is due to the shallow depth, thick oil zone, large areal extent, high oil saturation and the high quality of the low-gravity crude.

No other area in Texas contains so much "unrecoverable" oil. And several unusual reservoir features make this pilot test interesting to operators considering combustion recovery methods.

These factors had not been previously field-tested in an in situ combustion process:

1. The lower portion of the Wilcox is water bearing. It was not known whether the injected air would be used in moving the burning front or would bypass the oil zone in favor of the aquifer. Also, the high withdrawal rates associated with the combustion process could result in water coning at the production wells. There are no reports in the literature of a combustion project in an oil reservoir with an underlying aquifer.

2. There was no evidnce of a free gas saturation in the vicinity of the test wells. Pressure and time required to establish permeability to injected gas was questionable. The shallow reservoir also imposed a rather low limit on the maximum injection pressure to avoid lifting the overburden.

3. Producing sand is extremely fine and unconsolidated. Low primary production rates of less than 1 bbl. per day have resulted in severe sanding problems. The thermal-recovery project is expected to involve production rates greater than 100 bbl. per day, with gas-oil ratios between 2 and 10 M.c.f. per barrel. Expanding gas greatly increases the fluid velocities from a flowing well and multiplies the abrasive and erosive action of the produced sand.

TABLE 1—RESERVOIR AND CRUDE OIL CHARACTERISTICS

Depth to top of oil sand, ft	420
Net sand thickness, ft	30
Water saturation, %	20
Original oil in place, bbl. per acre-ft.	1,700
Reservoir temperature, °F.	70
Specific permeability, md.	5,000
Effective permeability to oil, md.	1,100
Viscosity at reservoir temperature, cp.	1,100
Oil gravity, °API at 60° F.	19
Initial boiling point, °F.	352

How test was started. An isolated, inverted five-spot test pattern, approximately 2½ acres in size, was drilled (see map). The producing wells were gravel-packed and 0.035-in. screen liners were placed opposite the producing zone for sand control. Production testing of the wells started in January 1959, and the four wells

made about 2 bbl. per day, total.

Characteristics of the reservoir and the crude oil are listed in Table 1.

Air was injected into the central pattern well near the end of January. Sufficient air was injected by April so that ignition was successfully completed, using an electric heater. Air-injection rate was then at 100 M.c.f.d. at a pressure of 400 psig.

A traverse of the injection well, conducted before ignition, showed a temperature increase of 40° F. to 113° F. bottom-hole temperature. This increase which could result only from a chemical reaction between the injected air and the formation oil, indicates the susceptibility of the reservoir oil to oxidation. Further evidence of low-temperature oxidation reaction was obtained from the gas analysis. No free oxygen was found in the produced gas at any time during the air-injection period.

Movement of burning front. Shortly after ignition, the oil production rate from the test pattern gradually increased from 2 to 10 bbl. per day. By the end of May the rate had increased to about 15 bbl. per day while the air-injection rate went from 100 to about 400 M.c.f.d. at a pressure of 450 psig. All wells were pumping at this time and the water cut of the produced fluids was about 5% with essentially no sand. Combustion was extremely efficient as indicated by the unusually high carbon dioxide content of the produced gas. This ranged between 14 and 16%, with no oxygen present at any time, and indicates an apparent atomic hydrogen-carbon ratio of the fuel of 1.4.

The heat front reached well B-10, in the southwest corner of the lease, on June 11, 1959. This high velocity, in excess of 3 ft. per day, at the low air-injection rate, indicates that the heat front moved with a very low vertical sweep. This type of premature break-through in a combustion project can be beneficial in a formation of low initial productive capacity as it accelerates oil production rates early in the project.

Field experience with the process has indicated that ultimate recovery is not adversely affected by early heating of the production wells. It does mean, however, that problems relative to producing a hot well are present for a longer time.

With the heat front at well B-10, the productivity of the well increased to a point where it was possible to produce at rates in excess of 100 bbl. per day. These rates were achieved while flowing the well only a few hours daily. The production was, however, accompanied by a considerable amount of sand.

The bottom-hole temperature stabilized at 320° F. in about 48 hours and remained fairly constant. Sand production did not decrease with continued production, and some of the gravel-pack material used to complete the well was observed on the second day.

With this indication of an apparent liner failure, the well was shut in and on June 29, 1959, a new liner was installed inside the original liner. The new liner had a screen opening of 0.007-in. as compared with the old 0.035-in. openings. The smaller openings proved too tight to allow adequate oil or gas-production rates.

Although the bottom-hole temperature at B-10 remained high, very little oil was produced until early October when the well was shot, using forty ⅜-in. jet perforators. Since that time the well has produced at rates of from 10 to 20 bbl. per day with no sand. The bottom-hole temperature of the well stabilized at 240° F., indicating that the burning front has not reached the well.

At this temperature the well should produce at higher rates, but the restricted well-bore area resulting from fine sand plugging the gravel pack and the small size of the liners now in place has resulted in decreased well producitvity.

Production of a hot well. The heat front moved into well B-9, the northwest corner well, in August 1959. In this case greater precautions were taken in controlling the fluid-withdrawal rates of from 50 to 150 bbl. per day were checked. The wellhead flowing pressure ranged from 275 to 350 psig., and the bottom-hole temperature ranged from 220° to 340° F. during this testing period.

Production rate was stabilized at 90 bbl. of fluid per day resulting in a net oil production of 50 bbl. daily. This flow rate was accomplished by holding the casing pressure at 320 psi. and the tubing pressure at 300-310 psi., cooling the well when necessary to result in a bottom-hole temperature of about 320° F. The sand cut was no higher than 2% and appeared to be dropping slowly after producing for 25 days at accelerated rates.

These results were encouraging and indicated that the fine reservoir sand could be controlled at fairly high production rates. Unfortunately, an accident occurred when a 2-in. side opening was knocked from the wellhead while installing surface equipment, causing the well to blow out.

The well was being controlled at a 20-psi. drawdown when the blowout occurred and the accompanying photo shows the tremendous productive capacity of the combustion process. At least 500 bbl. of oil, an equal amount of water and 2,500 cu. ft. of sand were blown from the well before it was controlled about 10 hours later. Attempts at successfully recompleting the well have failed because the formation had been disturbed to such an extent that the overburden has apparently caved at the well bore.

A look at the future. Further operations in the pilot-test area require that more air-compression equipment be added to the present plant capacity of about 800 M.s.c.f.d. to move the burning front into all production wells. Arrangements are being made at present to install the necessary compressors and a small expansion of the pilot is contemplated.

It will be about 1 year before the pilot test is completed and final answers to the Carrizo-Wilcox production problems and performance are determined with certainty.

What's been published on in situ combustion?

Why isn't fire flooding catching on in the industry? What are the advantages of in situ combustion over other secondary-recovery methods? Disadvantages? What does it take to set up a fire flood? What is meant by forward combustion? What is reverse combustion?

These questions and many more have been answered in articles appearing in recent issues of the Journal. The list below will help bring your personal or company files up to date.

California Fire Flood Gets More Oil But Costs High, Sept. 1, 1958, p. 106.

Fire Flood Has Bright Future, Socony Tells IOCC, Dec. 8, 1958, p. 45.

Here are Facts and Figures on 13 In Situ Projects, Sept. 15, 1958.

In Situ Combustion May Help Low-Gravity Texas Crudes, Mar. 30, 1959, p. 105.

McNeil, J. S. Jr., and Moss, J. T., Here's Where We Are on In Situ Combustion, Sept. 15, 1958, p. 232.

McNeil, J. S. Jr., and Nelson, T. W., Thermal Methods for Improving Oil Recovery, Jan. 19, 1959, p. 86.

Roberts, George, Jr., and Geffen, T. M., Fluid Injection for Oil Recovery, Aug. 25, 1958. p. 86.

Sinclair Aiming to Cut Costs Through More Research, Feb. 8, 1960, p. 62.

Swaminathan, V. S., In Situ Combustion Experiments in London, June 2, 1958.

—The editors

How to save money when you buy heads

A number of suggestions that may help you to reduce costs are contained in our new folder "Pertinent Facts on Purchasing Flanged and Dished Heads." Factors that govern the price of heads are described, and a list of the required data for orders and inquiries is included. Ordering from our stock sizes at Sparrows Point, Md., may save you time and money; a full list is contained in the folder. A copy is yours for the asking at any Bethlehem sales office.

Bethlehem makes flanged-and-dished heads to meet virtually every requirement: ASME Code, elliptical and standard flanged-and-dished. Also flanged-only, dished-only, shallow-dished, double-dished, and heads for special requirements.

Bethlehem heads are available in diameters up to 144-in. —and in thicknesses from 14 gage to 2½-in. We also produce standard manhole and hand-hole saddles, covers and fittings, as well as heads with flued openings. A number of sizes of ASME Code flanged-and-dished heads are stocked for prompt delivery.

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HUDSON Combin-aire

LOW TEMPERATURE COOLING USING COMBINATION OF MINIMUM WATER AND MAXIMUM AIR

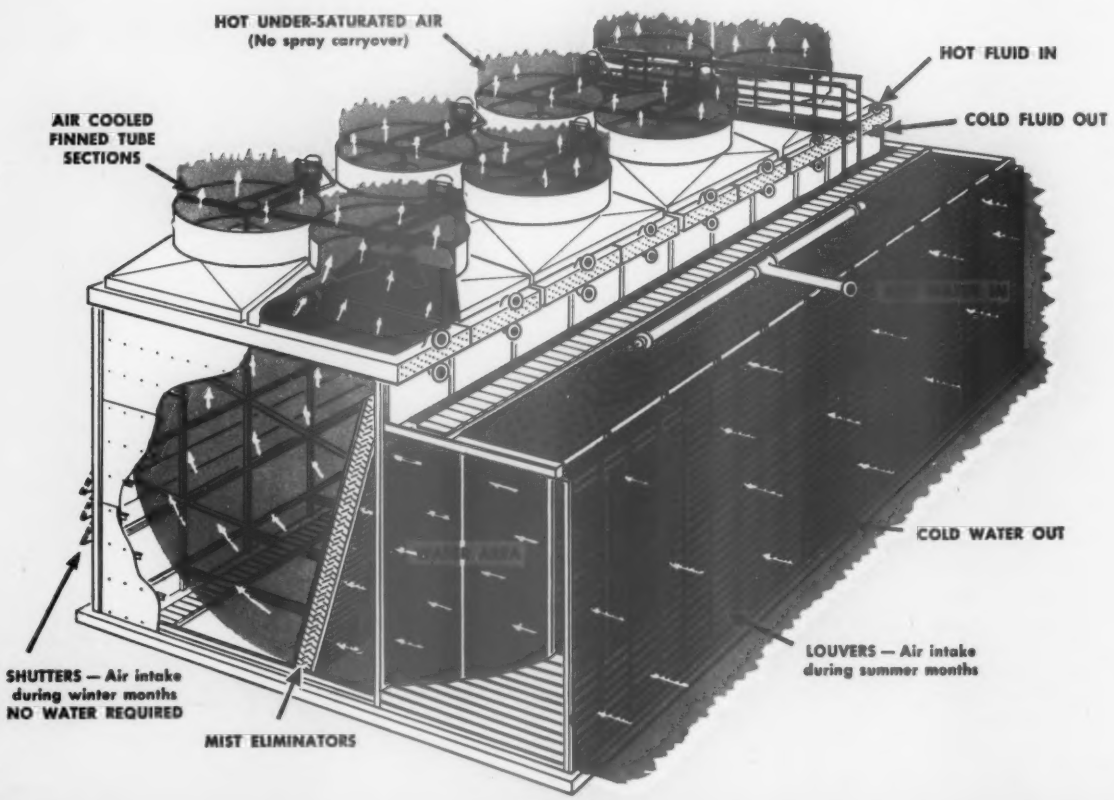
In recent years Hudson Solo-aire cooling in which only air is used as a cooling medium has been installed by the world's largest refineries. In recent cases of three separate 40,000 barrel complete refineries in locations where unlimited water is accessible Hudson Solo-aires are used for *all* process cooling.

So that air could be used for cooling those process streams requiring lower terminal temperatures than obtainable with ambient summer air temperatures, Hudson developed and in 1949 installed the first Combin-aire cooling unit. Since that time Combin-aires have proven their worth in installations for over 80 services in major refineries, chemical plants and gas processing plants in the United States, the Middle East, Europe, Mexico and South America.

In Combin-aire cooling, high temperature ambient air is first pre-cooled by direct contact with water, the cooled air then becoming the low temperature cooling medium for fin-tube elements. Cooling of air, and subsequent use of the cooled air for fin-tube cooling of process streams, are effected in one integrated structure — the Combin-aire.

Cooling with Combin-aire to overcome the occasional limitation of high ambient temperatures has the following advantages:

- **Absolute minimum water consumption consistent with attainment of low terminal process stream temperatures.**
- **Water circulation may be made automatically responsive to air temperatures with no water circulated except at high ambient temperature.**
- **No water treatment necessary. Salt water or brackish water may be used.**
- **No spray carryover or condensation. After passing across the fin-tube elements the heated air leaving the Combin-aire at elevated temperature is undersaturated with water vapor and cannot precipitate condensate or carry water spray.**
- **Minimum piping. Combin-aire may be installed immediately adjacent to other process equipment.**
- **Clean air to fin-tube units. During the hot season air is washed, removing dust, sand and insects.**


HOT UNDER-SATURATED AIR
(No spray carryover)
HOT FLUID IN
COLD FLUID OUT
AIR COOLED FINNED TUBE SECTIONS
COLD WATER OUT
LOUVERS — Air intake during summer months
SHUTTERS — Air intake during winter months NO WATER REQUIRED
MIST ELIMINATORS

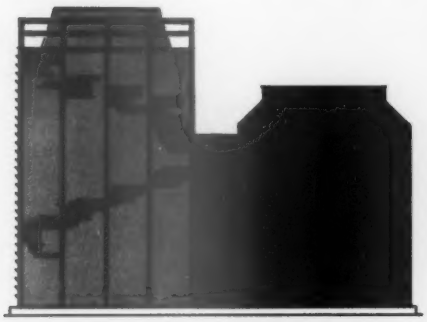
When Combin-aires are installed as adjuncts to cooling systems using existing shell and tube or other water cooled equipment the cooled water from the bottom of the Combin-aire may be used in such equipment. The Combin-aire then takes on the additional function of a water cooling tower with, however, the advantages over conventional cooling towers of dual use of both air and water and elimination of water spray carryover and condensate precipitation.

In over 80 services and under a wide range of atmospheric operating conditions Combin-aire units have amply fulfilled performance and mechanical specifications. Before proceeding with a new process unit or revamping or adding to present cooling systems let Hudson give objective assistance in determining the most economic balance in the use of air cooling, Combin-aire cooling and water cooling.

CONVERTING COOLING TOWERS INTO COMBIN-AIRE UNITS

Presently installed cooling towers may be used as the basis for Combin-aire cooling by installing structure with fin-tube elements and fans immediately adjacent to the cooling tower with air for the fin-tube elements being drawn across the water near the bottom of the cooling tower, thus increasing the capacity of the cooling tower, and cooling the air for use in the fin-tube elements.

EXISTING COOLING TOWER — **COMBIN-AIRE ADDITION**



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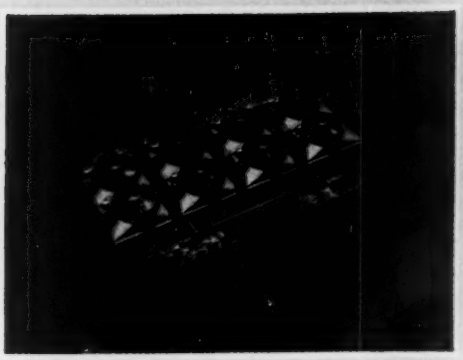

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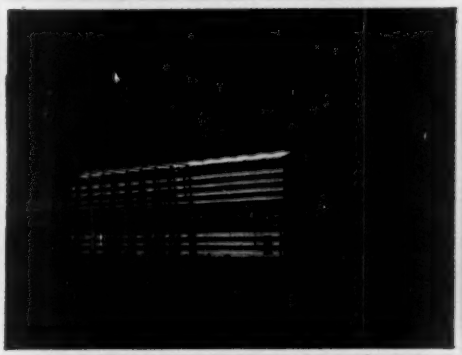

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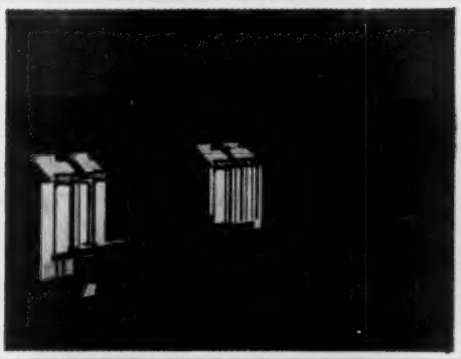

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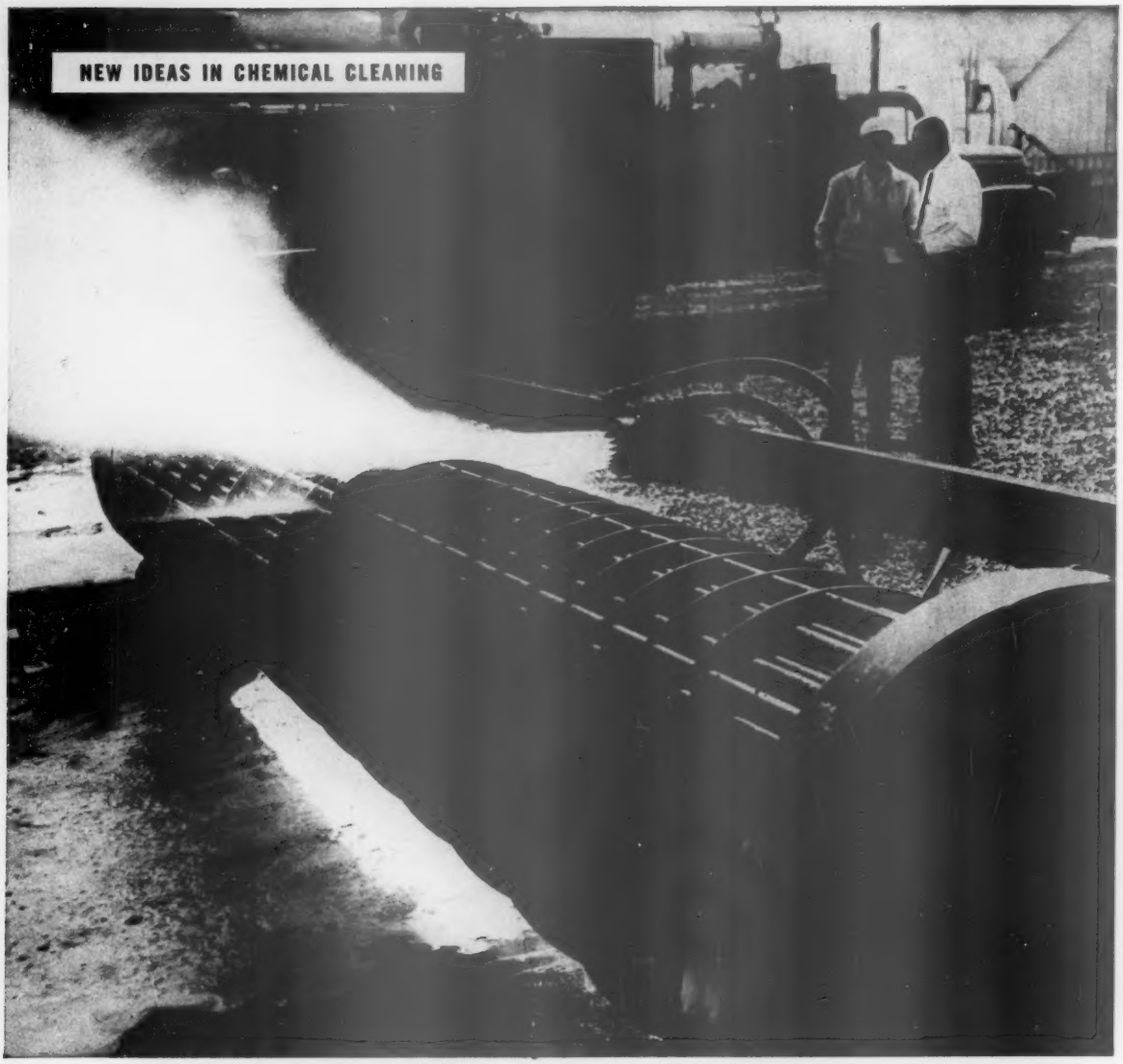


New Jetting Tool To Clean Tube Bundles Saves Thousands Of Dollars

The new high-pressure hydraulic tool, shown above, is currently saving thousands of dollars for companies in the refining, chemical, and petrochemical industries. It is the jetting tool developed by Dowell to remove deposits from heat exchanger tube bundles.

Previous methods of cleaning these bundles have been costly, time-consuming and often inadequate. Many times bundles had to be replaced completely because of the lack of a suitable cleaning method.

This new tool has a remarkable record of thorough, fast cleaning. For example, a slurry reboiler exchanger bundle, three feet in diameter and 16 feet long, was fouled with deposits of coke and asphalt. After being jetted from only one side, the bundle was thoroughly clean. Time required: less than one hour.

The tool holds the bundle in place for cleaning and has flanged rollers for rotation. The jet-head is manipulated automatically so that all tube spaces are covered. The jetted liquid can be either water or chemical solvents.

The new Dow Industrial Service Division will continue to offer the service which was formerly provided through the Dowell Division. For engineered recommendations to solve your cleaning problems contact the field office nearest you, or write Dow Industrial Service, 20575 Center Ridge Road, Cleveland 16, Ohio.

DOW INDUSTRIAL SERVICE

DIVISION OF THE DOW CHEMICAL COMPANY

DOW

Chemicals consumed in oil refining—a summary

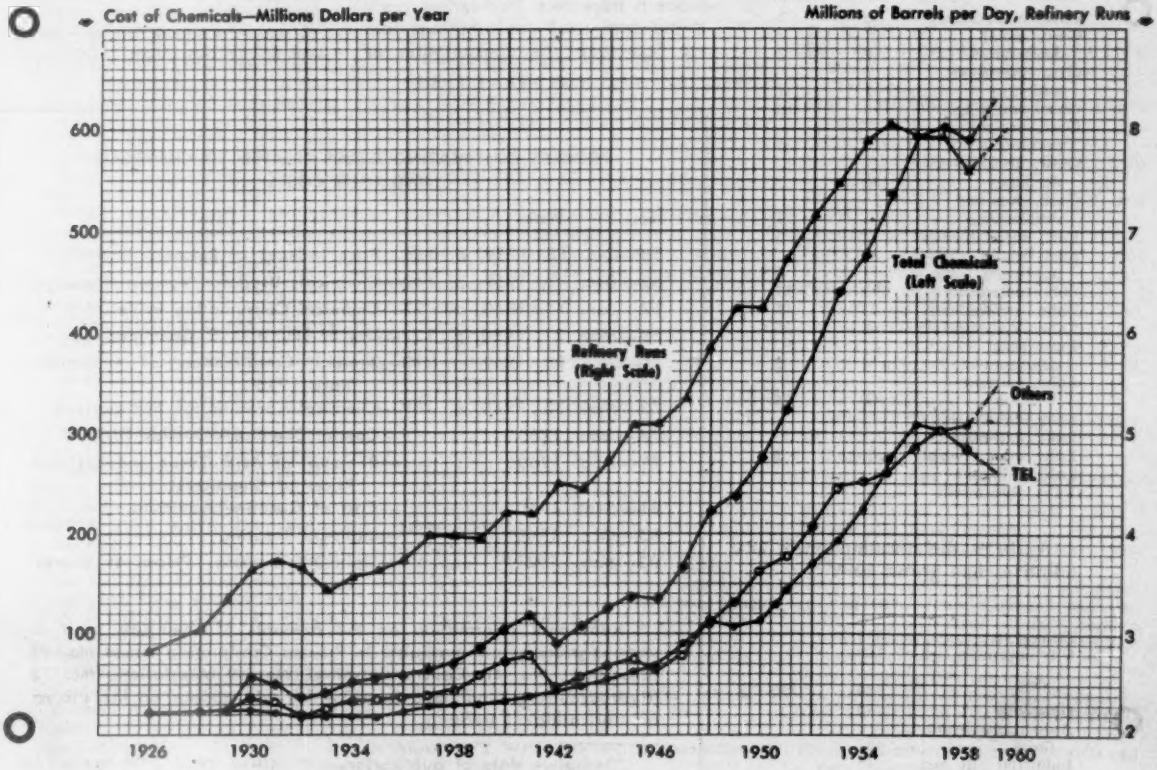
EXCEPT for the 1956 tabulation of chemicals consumed in petroleum refining (Process Costimating No. 64)[4], only one complete tabulation has appeared in the literature (Petroleum Administration for War)[1]. This tabulation applies to prewar 1941 and it lists 2,700,000 lb. of chemicals worth approximately $120 million. The 1941 tabulation appears to be reliable except that much more tetraethyl lead was consumed during 1940 and 1941 than shown (see correct figures in Process Costimating No. 68)[2].

The PAW report[1] also indicates the consumption of chemicals by a few large war-type plants during 1944 which produced 100-octane gasoline and only a small amount of lubricating oils. Had the entire industry operated in such a way, the consumption would have been $535 million worth of chemicals (of which $253 million was for tetraethyl lead),

TABLE. 1—COMPARISON WITH ACTUAL CHEMICAL CONSUMPTION OR SOME ESTIMATES OF THE LITERATURE

Type of Plant	Cents per bbl. Chemicals	Cents per bbl. TEL*	Cents per bbl. Total	Total found in this series†	Ref.
1931 mainly gasoline and fuels	1.1	2.2	3.3	3.7	5
mainly gasoline and fuels	3.1	2.2	5.3	3.7	5
mainly gasoline and fuels	1.4	2.2	3.6	3.7	5
mainly gasoline (sour crude)	4.4	2.2	6.6	‡	5
mainly gasoline (neutrals)	2.0	2.1	4.1	3.7	5
Mid-Continent lube refining	3.8	2.0	5.8	‡	5
Penna. lube refining	9.1	1.8	10.9	‡	5
1937 Average U.S.A.	2.23	2.7	4.9	4.5	5
1939 Average U.S.A.	2.22	3.7	5.9	6.0	5
1941 Average U.S.A.	2.78	5.1	7.9	7.6	1
1944 wartime 100-oct. plants	15.8	15.3	31.1	‡	1
1946 Large fuel-type plant	12.03	**1.51	13.54	7.2	5
1947 West Coast type of refinery	§5.9	3.7	9.6	8.6	7
1951 Average refineries	7.0	7.3	14.3	13.1	5 & 9
1952 Average refineries	9.2	7.6	16.8	14.3	6
1952 Gaso., jet and fuel plant (small)	¶2.0	11.6	13.6	‡	5
1958 Gaso. and asphalt (independent)	7.84	4.47	12.31	‡	5
1958 Gaso., asphalt and 1/5 to lubes (independent)	3.81	8.02	12.00	‡	5

*Estimated for that date as if the plant used the same TEL as the U. S. average, except as noted. †See Process Costimating No. 70, Approx. Annual Consumption . . . ‡Not comparable. §Lacks additives (other than TEL) for gasolines and lubes. ¶Lacks catalysts. ‖These figures from a very large refiner, appear to be incomplete. (Only 29% gaso.). **Actual TEL consumption.



REFINERY RUNS and costs of chemicals since 1926. Fig. 1.

and such figures are far above the average[8] indicated in Process Costimating No. 70. The cost of chemicals since 1926 is shown in Fig. 1.

Other literature[5-8] requires considerable estimating because of incomplete data but the results are compared in Table 1 with those[8] found in Process Costimating No. 70.

Solvent[9] requirements during 1951 for lube manufacture are indicated in Table 2. Petrochemical operations are also using a large amount of chemicals[8] (see Table 3) but this should not be confused with the regular refinery needs studied herein. The cost of such chemicals during 1951 was about $165 million.

According to Jensen[10], the 1956 usage of catalysts (excluding those for polymerization and alkylation) amounted to:

	10^6 lb.	10^6 dollars
Natural (cracking)	200	76
Synthetic (cracking)	350	
Platinum reforming	7.2	51
Molybdena-alumina	4	4
Chromia-alumina	2	.....
Cobalt-molybdate	0.6	.....

Less cracking catalyst is used now (1959) because of better feed preparation and stronger catalysts[12].

Additives are also being used in enormous amounts (1955).[11]

	10^6 lb.	10^6 dollars
Gaso. antioxidants	6	7
Gaso. metal deactivators	1.5	2
Gaso. corrosion inhibitors	5	1
Gaso. anti-icing	190	10
Gaso. preignition preventers	8	3
Gaso. upper cylinder lubes	140	5
Gaso. dyes and decolorizers	1	1
Fuel, miscellaneous	12	5
Fuel, cetane improvers	1	0.3
Lube, detergents	290	57
Lube, antioxidants	73	15
Lube, V.I. improvers	62	15
Lube, pour depressants	5	2
Lube, extreme pressure	60	14
Lube, defoamants	....	.....
Lube, anti-rust	....	.....
Lube, odor control	....	6
Lube, oiliness	....	.....
Lube, fluorescent dyes	....	.....

By 1959, the consumption of lube additives had grown to[13]:

	10^6 lb.	10^6 dollars
Detergents	325	
V.I. improvers, etc.	160	
	680	150-175
Gear oils	40	
Auto transmission fluids	32	
Industrial oils, etc.	15	
	87	75

TABLE 2.—SOLVENT REFINING REQUIREMENTS (1951)[9]
(pounds per year)

Furfural	9,200,000
Propane	26,080,000
Phenol	12,150,000
Cresol	4,780,000
Chlorex	1,320,000
Nitrobenzene	330,000
Ethylene dichloride	68,500
MEK	7,200,000
Benzene	3,176,300
Toluene	6,100,000
Aluminum chloride	83,000
Sulfur dioxide	5,000,000

TABLE 3.—PETROCHEMICAL NEEDS (1951)[8]
(million pounds per year)*

Sulfuric acid	3,000
Chlorine	2,000
Hydrofluoric acid	100
Hydrochloric acid	100
Bromine	108
Acetic acid	85
Lime	1,130
Caustic	525

*These are not included in the refinery chemical needs discussed in this series.

Current consumptions of chemicals must be obtained by a detailed estimate. It would seem that the Consumption Index of the magazine Chemical Engineering (shown on 1956 basis in Process Costimating No. 70)[8] could be used to project the consumption of chemicals by the industry. However, the Consumption Index is imperfect. For earlier years it indicates total consumptions that are less than the consumption of only sulfuric acid and caustic soda. It does not indicate the proper relationship between the consumptions for the reasonably accurate years of 1941 and 1956.

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2. Nelson, W. L., Use of Tetraethyl Lead in U. S. Gasolines, Process Costimating No. 68, The Oil and Gas Journal, March 21, 1960, p. 127.
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10. Jensen, J. T., Catalysts for the Petroleum Industry, Chem. & Eng. News, Aug. 20, 1956, p. 4090.
11. Larson, C. M., Additives for Fuels and Lubricants, Pet. Engineer, March 1955, p. C-44.
12. Anon., What's New in Catalysts, Petroleum Week, July 10, 1959, p. 166.
13. Anon., Additives Are Big Business, Chem. & Eng. News, June 1, 1959, p. 22.

PROCESS COSTIMATING ISSUES RELATED TO CHEMICALS AND THEIR COSTS

No.	Date	Title
58	Oct. 12, 1959, p. 186	Price Indexes of Refinery Chemicals
62	Dec. 7, 1959, p. 143	Chemicals Used for Various Processes
64	Jan. 11, 1960, p. 97	Chemical Consumption in Refining
68	Mar. 21, 1960, p. 127	Use of TEL in U. S. Gasolines
70	Apr. 25, 1960, p. 210	Annual Consumption of Chemicals Since 1926
72	May 30, 1960, p. 109	Chemical Consumption Summarized
74	June 1960*	—Cost of Chemicals Outside U. S. A.
79	Aug. 1960*	—Removal of Acid Gases (Indexes and Prices of Chemicals)
81	Sept. 1960*	—Cost of Gasoline Additives
83	Oct. 1960*	—Light-Oil Treating
85	Nov. 1960*	—Light-Oil Treating—Prices of Chemicals

Additional information on the amounts of chemicals used in various processes is available in Process Costimating issues No. 43 (Desalting), No. 49 (Caustic Washing), No. 69 (Alkylation), No. 73 (Hydrodesulfurization), and issues which will appear on the subject of lubricating-oil treating.

*Tentative date of publication.

Monthly Report on PIPELINE CONSTRUCTION

PIPELINE ACTIVITY reported here is compiled from surveys by The Oil and Gas Journal among pipeline companies and construction contractors.

This summary report appears in the last issue of the Journal each month. New construction projects are reported weekly in Pipeline Briefs in the Journal's news section.

Projects are listed in three groups—U. S., Canadian, and Foreign—and according to type of line—crude, products, or natural gas.

★ The star symbol indicates the first appearance of the project in the Journal's survey.

U.S. Crude Oil Pipelines

BELLE FOURCHE PIPELINE CO., Box 1612, Casper, Wyo.
Project: 103-mile 8-in. line from Fiddler Creek field to Lance Creek, Wyo., and other lines to serve Roset, Miller Creek, and Lone Tree fields.
Status: Pending approval of Wyoming Public Service Commission.

BUCKEYE PIPE LINE CO., 30 Broad St., New York 4, N. Y.
Project: 54 miles of large-diameter extension in Michigan. The 22-in. line will be extended from Toledo to Samaria, and a 16-in. line will be built from Samaria to Trenton and Detroit.
Status: Bids received in May.

CAPE PIPE LINE CO. (Sun Oil Co., Cities Service Co., Atlantic Refining Co.), Philadelphia.
Project: Line from lower Delaware Bay to Philadelphia.
Status: Planned.

GILLETTE PIPELINE, INC., and A. W. HARTWIG, INC.
Project: A 102-mile line from Dead Horse Creek field to Casper, Wyo.
Status: Pending Wyoming Public Service Commission approval.

GREAT NORTHERN RAILWAY, St. Paul.
Project: 110-mile line from Lignite and Newburg fields to Minot, N. D.
Status: Has state approval.
Completion: Before next winter.

HUMBLE PIPE LINE CO., Box 2220, Houston 1, Tex.
Project: 63 miles of 8-in. trunk line to Sacotosa field in Southwest Texas.
Completion: Early summer 1960.

INTERNATIONAL OIL PIPELINE CORP., New York.
Project: Would own U. S. section of 1,500-mile, 30-in. line proposed by Mid-Continent Pipe Lines, Ltd., from Edmonton, Alta., to Chicago. (See Canada).
Status: Proposed.

MATADOR PIPE LINE CORP., Denver.
Project: 175-mile line from Burke, Bottineau, and Renville counties, North Dakota, to Cromer, Man.
Status: Pending approval of Canadian National Energy Board.

NORTHWESTERN REFINING CO., Box 248, St. Paul Park, Minn.
★ Project: Gathering system in Rival and Lignite fields, North Dakota.
Status: Has state approval.

STANDARD OIL CO. OF CALIFORNIA, San Francisco.
Project: 22 miles of 8-in. from Swanson River Unit to Nikiski on Cook Inlet, Alaska.
Status: Planned.
Completion: Mid-1961.

U. S. Products Pipelines

CONTINENTAL PIPE LINE CO., Drawer 1267, Ponca City, Okla.
Project: 85-mile 6-in. line from Helena to Great Falls, Mont.
Status: To start in June.
Completion: By September 1, 1960.

FARMERS UNION CENTRAL EXCHANGE, INC., Box G, St. Paul 1, Minn.
Project: 200 miles of 8-in. from Glendive, Mont., to Minot, N. D.
Status: Bids to be taken about June 1, 1960. Pipe Line Technologists, Inc., Houston, is project engineer.
Completion: Early fall 1960.

GREAT LAKES PIPE LINE CO., Drawer 2239, Kansas City 42, Mo.
Project: 58 miles of 8-in. from Grinnell to Waterloo, Iowa.
Status: Under way.

HUMBLE OIL & REFINING CO., Houston.
Project: About 34 miles of 4-in. from Baytown to Texas City.

HUSKY OIL CO., Cody, Wyo.
Project: About 100 miles from Cody to the Yellowstone products line west from Billings, Mont.
Status: Planned.
Completion: Late 1960.

MID-AMERICA PIPELINE CO., (Missouri-Kansas-Texas Railroad), New York.
Project: 2,300-mile LPG system from West Texas-New Mexico area to upper Midwest. Size of pipe would be 8 and 10-in. with branches 6 to 8-in.
Status: Under way.
Contractor: Williams Brothers Co., Tulsa.
Completion: December 1960.

NEW HAVEN PIPELINE, INC., 515 Madison Ave., New York 22, N. Y.
Project: 12-in. line from New Haven to Hartford, Conn., and 10-in. from there to Springfield, Mass., with a 6-in. spur to Westover Air Base at Ludlow, Mass.
Status: Proposed.

PHILLIPS PETROLEUM CO., Bartlesville, Okla.
Project: 45 miles of 3-in. from Artesia, N. M., to Phillips' Mex.-Tex. line.
Status: Planned.

SEADRIFT PIPELINE CORP. (subsidiary of Union Carbide Corp.).
Project: 108 miles of line from Seadrift to Ella, Tex.
Status: Planned.

TEXAS EASTERN TRANSMISSION CORP., Box 1189, Houston.
Project: 90-mile extension of Little Big Inch from Lebanon to Lima, Ohio.
Status: Planned.
Project: 10 miles of 8-in. LPG line from Mt. Belvieu to Baytown, Tex.
Completion: June 1960.

TEXAS PIPE LINE CO., 1111 Rusk Avenue, Houston, Tex.
Project: 42 miles of 6-in. LPG line from the New Hope natural-gasoline plant in Franklin County, Texas, to the Nettleton station.
Status: Under way.
Contractor: M. L. (Jack) Moore Construction Co., Odessa, Tex.
Completion: June 1960.

U. S. Natural Gas Pipelines

AMERE GAS UTILITIES CO., Box 1273, Charleston 25, W. Va.
★ Project: 16 miles of 10-in. from Carbon to Wingrove, W. Va.
Completion: Late summer 1960.

ANCHORAGE GAS CORP., Houston.
Project: 165 miles of line at least 12-in. in diameter from Kenai Peninsula to Anchorage.
Status: Planned.

ARKANSAS INDUSTRIAL PIPELINE CORP. (Arkansas Louisiana Gas Co.), Shreveport.
Project: 130 miles of 18-in. from Perla to Helena, Ark.
Completion: Fall 1960.

ARKANSAS LOUISIANA GAS CO., Shreveport.
Project: About 58 miles of 2, 3, 4, and 6-in. line in various locations.
Completion: 1960.

ATLANTIC SEABOARD CORP., Box 1273, Charleston 25, W. Va.
★ Project: 13 miles of 26-in. and 6 miles of 20-in. loop in Virginia and Maryland.
Status: Pending FPC approval.
★ Project: 45 miles of 20-in. from Terra Alta storage site to Seneca station, W. Va.
Status: Under way.
Contractor: Williams Brothers Co., Tulsa.

CAROLINA PIPELINE CO., Box 1531, Columbia, S. C.
Project: 12 miles of 6-in. in the Florence, S. C., area.
Status: Planned.
Completion: June 15, 1960.

CITIES SERVICE GAS CO., Box 1995, Oklahoma City 1, Okla.
Project: 13 miles of 16-in. from Alden field, Rice County, Kansas, to the company's Lyons station; 10 miles between Lyons and Hutchinson; and 9 miles near Wichita.
Status: Pending FPC approval.
Completion: By fall 1960.

COASTAL STATES GAS PRODUCING CO., Corpus Christi, Tex.
Project: 60 miles of 10-in. in La Salle and Frio counties, Texas.
Completion: June 1960.

COASTAL TRANSMISSION CORP., Houston.

PIPELINE CONSTRUCTION

Project: 65 miles of 3, 4, 6, and 10-in. in Texas and Louisiana.
Status: Pending before FPC.
Completion: Summer 1960.

COLORADO INTERSTATE GAS CO., Box 1087, Colorado Springs.
Project: 7 miles of 20-in. in Texas Panhandle.
Status: Pending FPC approval.
Completion: 1960.
Project: 109 miles of 26-in. from Texas Panhandle to Morton Junction in southeastern Colorado; 135 miles of 34-in. from there to Pueblo, and 107 miles of 30-in. on to Denver; 155 miles of 34-in. from Rock Springs, Wyo., to Provo, Utah.
Status: Pending FPC approval.
Completion: 1960.
Project: 32 miles of 6-in. from Central Colorado to Trinidad.
Status: Pending FPC approval.
Completion: 1960.

COLORADO OIL & GAS CORP., Denver.
Project: 402-mile line from Gubik field to Fairbanks, Alaska.
Status: Proposed.

COLUMBIA GULF TRANSMISSION CO., Box 1916, Houston, Tex.
Project: 6 miles of 24 and 30-in. at Mississippi River crossing near Providence, La.
Status: Pending FPC approval.
Completion: November 1, 1960.

EL PASO NATURAL GAS CO., Box 1492, El Paso, Tex.
Project: 19 miles of 20-in., 40½ miles of 16-in., 26 miles of 12-in., and 36 miles of 10-in. from existing 26-in. main line in Cowlitz County, Washington, to Eugene, Ore.
Status: Under way.
Contractors: Hood Construction Co., Whittier, Calif., and River Construction Corp., Fort Worth, Tex.
Completion: Fall 1960.
Project: 17 miles of 5-in. lateral from an interconnection with Pacific Gas Transmission Co.'s proposed 36-in. line in Klamath County to near Klamath Falls, Ore.
Status: Pending FPC approval.
Project: 24 miles of 20-in. from Puckett, Tex., to Goldsmith plant; 51.3 miles of 20-in. from Terrell to Puckett Plant discharge; and 23 miles of 20-in. from Goldsmith to Eunice-Dumas line.
Completion: 1960-61.
Contractor: Western Pipe Line, Inc., Austin, Tex., has contract for 52 miles of 20-in., with work under way.
Project: 244 miles of 30-in. Permian-San Juan Line loops.
Status: Under way.
Contractor: R. H. Fulton & Co., Lubbock, Tex., has contract for 126 miles in New Mexico, with office in Tatum, N. M.
Completion: 1960-61.
Project: 395 miles of 34-in. from Salt Lake City, to California border near Las Vegas, Nev.
Status: Pending FPC approval.
Completion: January 1, 1961.

EQUITABLE GAS CO., 420 Boulevard of the Allies, Pittsburgh, Pa.
Project: 58 miles of 16 and 20-in. from Marion County, West Virginia, to Washington County, Pennsylvania.
Status: Pending FPC approval.
Completion: Fall 1960.
Project: 17 miles of 16-in. in Marion and Monangalia counties, West Virginia.
Contractor: Joyce Pipeline Co., Andover, N. Y.
Completion: August 15, 1960.

GULF RESOURCES INC., New York.
Project: 136 miles of 14 and 20-in. from Hidalgo County to LaSalle County, Texas.
Status: Pending FPC approval.

HOPE NATURAL GAS CO., Clarksburg, W. Va.
Project: 20 miles of 24-in. line in Wetzel and Monongalia counties, West Virginia, replacing two 16-in. lines.
Status: Approved.
Contractor: Sheppard-Geiger Construction Co., Corpus Christi, Tex.

HOUSTON TEXAS GAS & OIL CORP., Box 10400, St. Petersburg 33, Fla.
Project: 270 miles of 2 to 6-in. lateral lines.
Status: Pending FPC approval.

IRON RANGES NATURAL GAS CO., St. Paul.
Project: 79 miles of 10 and 12-in. from Grand Rapids to Hoyt Lake, Minn., and 67 miles of 12-in. from Duluth to Silver Bay, Minn.
Status: Approved by FPC.
Completion: 1960.

KANSAS-NEBRASKA NATURAL GAS CO., INC., Phillipsburg, Kans.
Project: Enlargement of gathering facilities in Kansas' Hugoton field, including 10 miles of 8-in., 10 miles of 20-in., and about 2 miles of 26 and 30-in.
Completion: August 1, 1960.
Project: 15 miles of 4-in. from Kimball, Neb., to a gathering line north of Kimball.
Completion: July 1, 1960.
Project: 56 miles of 2-in. to serve several communities in Kansas.
Completion: September 1, 1960.

MANUFACTURERS LIGHT & HEAT CO., Union Trust Building, Pittsburgh 19, Pa.
Project: 70 miles of 20-in. from Sideling Hill Mountain to Abbottstown, Pa.
Status: Under way.
Contractor: Williams Brothers Co., Tulsa, Okla.
Completion: September 1960.
Project: 33 miles of 20-in. from Point Marion to Route 40 near Addison, Pa.
Status: Planned.
Completion: September 1960.
Project: About 8 miles of 4 to 16-in. line in the Victory storage area, West Virginia.
Status: Planned.
Completion: September 1960.

MICHIGAN CONSOLIDATED GAS CO., 415 Clifford St., Detroit 26, Mich.
★ Project: 18 miles of 10-in. from Ludington to Manistee, Mich.
Contractor: Welded Construction Co., Rosebush, Mich.
Completion: June 30, 1960.

MICHIGAN WISCONSIN PIPE LINE CO., 500 Griswold Street, Detroit 26, Mich.
Project: 342 miles of 24-in. and 188 miles of 30-in. main-line loop.
Contractors: R. H. Fulton & Co. has 270 miles in Texas, Oklahoma, and Kansas; Bechtel Corp., 120 miles in Illinois and Indiana; Majestic Contractors, 60 miles in Illinois; and Somerville Construction Co., 80 miles in Michigan.
Completion: September 1, 1960.
Project: 9 miles of 6-in., 17 miles of 8-in., and 11 miles of 12-in. lateral loops in Wisconsin.
Status: Pending FPC approval.
Completion: September 1, 1960.
Project: 69 miles of 24-in., 28 miles of 20-in., 96 miles of 16-in., and 118 miles of 4 to 8-in. in Wisconsin.
Status: Approved by FPC.
Completion: November 1, 1960.
Project: 29 miles of 30-in. main-line loops.
Status: Pending FPC approval.
Completion: November 1, 1960.

MIDWESTERN GAS TRANSMISSION CO., Houston.
Project: 504 miles of 24-in. from Emerson, Man., to Marshfield, Wis., plus 54 miles of sales laterals.
Status: Construction to start spring 1960.
Completion: November 1, 1960.

MISSISSIPPI RIVER FUEL CORP., 407 North 8th Street, St. Louis 1, Mo.
Project: 5 miles of 16-in. and 15 miles of 12-in. from Collinsville, Ill., to St. Jacob, Ill.
Status: Pending FPC approval.

MISSISSIPPI RIVER TRANSMISSION CORP. (Mississippi River Fuel Corp.), St. Louis.
Project: 115 miles of 24-in. from near Oran in southeast Missouri to St. Louis County.
Status: Planned.
Completion: Last half 1960.

MOUNTAIN FUEL SUPPLY CO., 180 East 1st South Street, Salt Lake City.
Project: 7 miles of 24-in. from Mountain Dell to Salt Lake City.
Status: Proposed.
Completion: 1960.
Project: 6 miles of 20-in. from Kanda Junction to Green River, Wyo.
Status: Proposed.
Completion: 1960.

NATURAL GAS GATHERING CO., INC., Corrigan Tower, Dallas, and **GULF RESOURCES, INC.**
Project: 31 miles of 10, 12, and 14-in. in Zapata and Starr counties, Texas.
Status: Pending FPC approval.
Completion: Fall 1960.

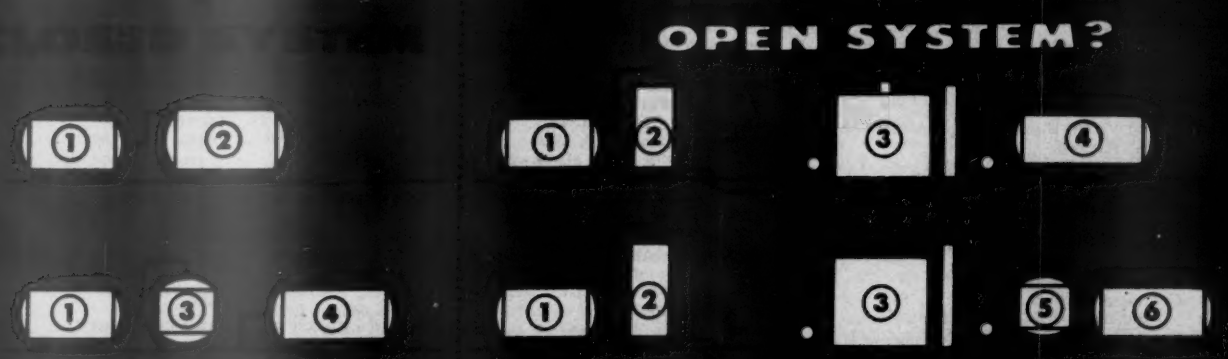
NATURAL GAS PIPELINE CO. OF AMERICA, 122 South Michigan Avenue, Chicago.
Project: 5 miles of 8-in. in Grady County, Oklahoma.
Status: Pending FPC approval.
Project: About 18 miles of 4 to 10-in. gathering lines in Carson County, Texas.
Status: Pending FPC approval.
Project: 151 miles of 36-in. intermittent sections paralleling mainline falicities between Ford County, Kansas, and Joliet, Ill.
Status: Pending FPC approval.
Project: 180 miles of 24-in. between Kiowa County, Oklahoma, and Minneola, Kans.
Status: Pending FPC approval.

NIAGARA MOHAWK POWER CORP., Syracuse, N. Y.
Project: 104 miles of 12-in. from Watertown, N. Y., to Massena, N. Y.
Status: Planned.
Completion: November 1960.
Project: 22 miles of 6-in. from Massena to Malone, N. Y.
Status: Planned.
Completion: November 1960.
Project: 17 miles of 6-in. from Watertown to Carthage, N. Y.
Status: Planned.
Completion: September 1960.

NORTHERN ILLINOIS GAS CO., 50 Fox Street, Aurora, Ill.
Project: 75 miles of 30-in. from Troy Grove storage field to LaGrange, Ill.
Status: Under way.
Contractor: Contracting & Material Co., Evanston, Ill.
Completion: Early fall 1960.

NORTHERN NATURAL GAS CO., Omaha.
Project: 217 miles of main line, 221 miles of main-line loops, and 2,178 miles of branch lines of various diameters.
Completion: 900 miles were completed in 1959.
Project: About 21 miles of 16-in. and 26 miles of various small diameter pipeline in the Glick field, Kansas, area.

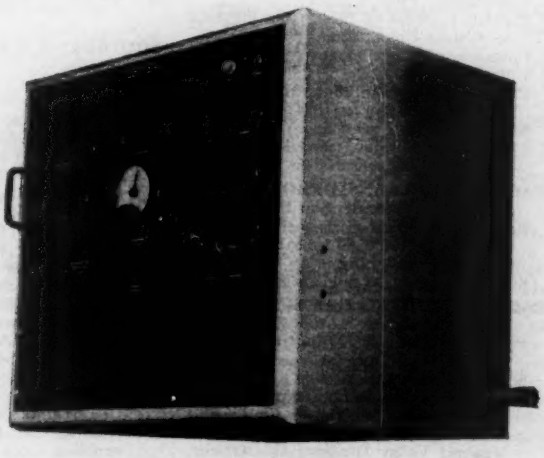
Does Your **Waterflood or Disposal** Problem Require...



BS&B AQUA-Kleener* Systems Include Both Types!

Your BS&B Representative can help you take the "guess-work" out of your waterflood or disposal problem. Whether you need a simple *closed type* system which excludes air from the process, or a more elaborate *open type* system which uses air as a part of the treatment, he can recommend the correct system from BS&B's full line of AQUA-KLEENER water treating equipment to solve your problem most efficiently and economically.

For the best possible field care of either permeable plate or graded bed type filters, the BS&B PHANTO-MATIC* Filter Backwash Controller is available to operate on either a time-cycle or a preset filter bed differential pressure. A complete installation including the PHANTO-MATIC Filter Backwash Controller and pumps is offered as a skid-mounted unit, ready for installation in the flow line.



* AQUA-KLEENER and PHANTO-MATIC are trade names of Black, Sivalls & Bryson, Inc.

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PIPELINE CONSTRUCTION

Status: Pending FPC approval.
Project: 188 miles of 24-in. and 215 miles of 30-in. from Farmington, Minn., to International border.
Status: Proposed.
Project: 83 miles of 20-in. from East Dubuque, Ill., to Janesville, Wis.
Status: Pending FPC.
Completion: Fall 1960.

OHIO FUEL GAS CO., 99 North Front Street, Columbus 15, Ohio.
Project: 21 miles of 4½ to 24-in. line in various counties in Ohio.
Status: Pending FPC approval.

OKLAHOMA RESOURCES DEVELOPMENT CO., Cameron Building, Oklahoma City.
Project: About 170 miles of 12-in. trunk line from Oklahoma City to Harrah and Muskogee, Okla., and about 130 miles of 4 to 12-in. lateral from Hughes County and from Blaine and Logan counties.
Status: Planned.
Completion: November 1, 1960.

OLD OCEAN FUEL CO. (subsidiary of Texas Electric Service Co.). Fort Worth.
Project: 364 miles of 16, 20, and 24-in. from the Gulf Coast south of Houston to the Fort Worth area.
Status: Under way.
Contractors: H. B. Zachry Co., San Antonio, Tex., and O. R. Burden Construction Corp., Tulsa, Okla.
Completion: December 1960.

PACIFIC GAS & ELECTRIC CO., San Francisco.
★ Project: 9 miles of 12-in. from Berenda Creek to Chowchilla, Calif.
Status: Planned.
Contractor: Company crews.
Completion: 1960.
★ Project: 8 miles of 16 and 2 miles of 10-in. Fresno reinforcement.
Status: Planned.
Contractor: Company crews.
Completion: 1960.
★ Project: 7 miles of 16-in. from Ignacio to Petaluma, Calif.
Status: Planned.
Contractor: Company crews.
Completion: 1960.
★ Project: 67 miles of line from Kettleman Hills to Morro Bay, Calif.
Project: 120 miles of 34-in. looping of Topock-Milpitas main line.
Status: Planned. Pending FPC approval.
Completion: 1961.
Project: 11 miles of 20-in. from Pittsburg to Walnut Creek, Calif.
Contractor: Using company crews.
Completion: 1960.
Project: 296 miles of 36-in. from the California-Oregon border to Antioch, Calif.
Status: Pending state approvals.
Completion: 90 miles scheduled for completion in 1960, the rest in 1961.

PACIFIC GAS TRANSMISSION CO. (Pacific Gas & Electric, San Francisco).
Project: 614 miles of 36-in. from Kingsgate, B. C., to California border near Klammath Falls, Ore.
Status: Has FPC examiner's approval.

PACIFIC LIGHTING GAS SUPPLY CO., Los Angeles.
Project: 116 miles of 34-in. from Needles to Newberry, Calif.
Status: Under way.
Contractors: Engineers Limited Pipeline Co., San Francisco, and Pacific Pipeline Construction Co., Montebello, Calif. Missouri Valley Dredging Co., Omaha, has contract for a dual 24-in. crossing of the Colorado River near Needles.
Completion: July 1, 1960.

PANHANDLE EASTERN PIPE LINE CO., 1221 Baltimore Avenue, Kansas City, Mo.
Project: 100 miles of 4 to 12-in. gathering lines.
Contractor: Hall Construction Co., Liberal, Kans.
Completion: December 31, 1960.
Project: 315 miles of 30-in. and 40 miles of 26-in. loops on main line.
Status: Pending FPC approval.
Completion: Fall 1960.

PEOPLES GAS LIGHT & COKE CO., 122 South Michigan Avenue, Chicago 3, Ill.
Project: 29 miles of 36-in. in the Chicago area.
Status: Planned.
Completion: 1960-62.

PEOPLES GULF COAST NATURAL GAS PIPELINE CO., 122 South Michigan Avenue, Chicago 3, Ill.
Project: 371 miles of 30-in. of present system between Texas and Chicago.
Status: Pending FPC approval.
Completion: November 15, 1960.
Project: About 59 miles of various size looping of main line in Texas.
Status: Pending FPC approval.
Completion: November 15, 1960.

PEOPLES NATURAL GAS CO., Two Gateway Center, Pittsburgh 22, Pa.
Project: 37 miles of 12 and 20-in. in various parts of Pennsylvania.
Status: Planned.
Contractor: Joyce Western Corp. has contract for 8 miles of 20-in. from Imperial to Aliquippa, Pa.
Completion: From June to October 1960 for most of the line.

PHILLIPS PETROLEUM CO., Bartlesville.
Project: 85 miles of 2 to 16-in. gathering lines in Eddy County, New Mexico.
Status: Under way.
Contractor: Lasley Construction Co.
Completion: October 16, 1960.

PIONEER NATURAL GAS CO., Amarillo.
Project: 21 miles of 12-in. from Sudan to Muleshoe, Tex.
Status: Pending FPC approval.
Project: 12 miles of 10-in. from Muleshoe, Tex. northward.
Status: Pending FPC approval.

PUBLIC SERVICE CO. OF NORTH CAROLINA, Gastonia, N. C.
Project: About 47 miles of 4, 8, and 10-in. in North Carolina.

ROCKY MOUNTAIN NATURAL GAS CO.
Project: 65 miles of gas line in southwestern Colorado to supply Collbran, Montrose, Delta, and Orchard City.
Status: Planned.

SOUTHERN CALIFORNIA GAS CO., Los Angeles.
Project: 13 miles of 34-in. from San Fernando Valley to West Los Angeles.
Status: Approved.
Completion: 1960.

SOUTHERN CALIFORNIA GAS CO., and **SOUTHERN COUNTIES GAS CO. OF CALIFORNIA,** Los Angeles.
Project: 93 miles of 34-in. from Ivanpah to Newberry, Calif.
Status: Pending FPC approval.
Completion: 1961.
Project: 115 miles of 36-in. from Newberry to Placentia, Calif.
Status: Under way.
Contractors: Young & Anderson Co., Brea, Calif., has contract for 85 miles from Newberry to Fontana. Contractors for the remainder are Hood Construction Co., Whittier, Calif.; J. P. Neill & Co., Dallas; and River Construction Corp., Fort Worth, Tex.
Completion: August 1960.

ST. LAWRENCE GAS CO., Ogdensburg, N. Y.
Project: 75 miles of line from Cornwall, Ont., to Ogdensburg, N. Y.
Status: Pending FPC approval.

TENNESSEE GAS PIPELINE CO., Box 2511, Houston, Tex.
Project: 155 miles of 30 and 36-in. loops in Ohio, Pennsylvania, and New York, and 72 miles of gathering line.
Status: Pending FPC approval.
Project: 21 miles of 16-in. gathering line from Louisiana coast to Block 46 in the Vermilion area.
Status: Pending FPC approval.
Project: 2 miles of 12-in. gathering line in East Cameron area, offshore Louisiana.
Status: Pending FPC approval.
Project: 158 miles of 36-in. gas loop between Kinder, La., and Centerville, Tenn.
Status: Approved by FPC.
Project: 41 miles of 30-in. loop east of Hamburg, N. Y.
Status: Pending FPC approval.
Project: 25 miles of 30-in. loop near Kane, Pa.
Status: Pending FPC approval.

TENNESSEE GAS TRANSMISSION CO., Box 2511, Houston, Tex.
Project: 11.5 miles of 16-in., 32 miles of 12-in., 9.8 miles of 10-in. off Louisiana coast.
Status: Pending FPC approval.
Completion: Fall 1960.

TEXAS EASTERN TRANSMISSION CORP., Shreveport, La.
Project: 85 miles of 24-in. from Tamarack, to Perulack, Pa.
Status: Pending FPC approval.
Project: 40 miles of 36-in. from Lambertville, to Linden, N. J.
Status: Pending FPC approval.
Project: 23 miles of 20-in. from Eagle, to Chester Junction, Pa.
Status: Pending FPC approval.
Project: 53 miles of 30-in. from Perulack, Pa., to Lambertville, N. J.
Status: Pending FPC approval.

TEXAS GAS TRANSMISSION CORP., Box 577, Owensboro, Ky.
Project: 24 miles of 30-in. south of Bastrop, La., and 56 miles of 12-in loop in Indiana.
Status: Pending FPC approval.
Completion: Fall 1960.

TRANSCONTINENTAL GAS PIPE LINE CORP., Houston, Tex.
Project: 69 miles of 30-in., 269 miles of 36-in., and 7 miles of 16-in. in various states.
Status: Pending FPC approval.
Completion: 1960.

TRANSWESTERN PIPELINE CO., Houston.
Project: 490 miles of 24 and 20-in. from Texas to Roswell, N. M., and to Topock, Ariz. Also, 300 miles of 10, 12, and 16-in. lateral lines in Texas and New Mexico.
Status: Under way.
Contractors: Houston Contracting Co., Houston, and H. C. Price Co., Bartlesville, Okla., have joint contract to build the main line. As for the 300 miles of laterals, Houston Contracting will carry out this work with R. H. Fulton & Co., Lubbock, Tex., and Western Pipe Line, Inc., Austin, Tex.
Completion: July 1960.
Project: 300 miles of 4, 6, and 8-in. gathering lines in the Texas Panhandle, northwestern Oklahoma, Southwest Texas, and southeastern New Mexico.
Contractor: Sheehan Pipe Line Construction Co., Tulsa.
Completion: July 15, 1960.

TRUNKLINE GAS CO., Box 1642, Houston.

PIPELINE CONSTRUCTION

Project: 31 miles of 30-in. from Longville to Pitkin, La.; 58 miles of 30-in. from Riverton to Kilbourne, La.; 63 miles of 30-in. from Ballentine, Miss., to Canadaville, Tenn.; 65 miles of 30-in. from Bardwell, Ky., to Marion, Ill.; and 35 miles of 30-in. from Neoga to Bourbon, Ill.
Status: Pending FPC approval.
Project: 140 miles of supply lateral in South Louisiana, including a 17-mile 24-in. loop of an existing lateral and 123 miles of 20, 24, and 26-in.
Status: Pending FPC approval.
Completion: Fall 1960.
Project: 42 miles of 24-in. loop from west of Moss Hill, to Silsbee, Tex.
Status: Under way.
Contractor: Sharman, Allen, Gay & Taylor, Inc., Houston.
Completion: Mid-1960.
Project: 53 miles of 30-in. loop from Pitkin, to Pollock, La.
Status: Under way.
Contractor: Grayco Constructors, Inc., Austin, Tex.
Completion: Mid-1960.
Project: 61 miles of 30-in. loop from Pollock, to Riverton, La.
Status: Under way.
Contractor: APV Co., Inc.
Completion: Mid-1960.
Project: 177 miles of 30-in. loops in Louisiana, Arkansas, Mississippi, Tennessee, and Kentucky.
Status: Under way.
Contractor: Panama, Inc., Houston.
Project: 62 miles of 26-in. extension from Bourbon to Rossville, Ill.
Status: Under way.
Contractor: Contracting & Material Co., Evanston, Ill.

UNITED GAS PIPE LINE CO., Box 1407, Shreveport 92, La.
Project: 39 miles of 36-in. purchase lateral connecting Bastian Bay field, Louisiana.
Status: Pending FPC approval.
Completion: Fall 1961.

Canadian Crude Oil Pipelines

ACT OILS, LTD.
Project: A 450-mile line from the Peace River region to tidewater at Kitimat, B. C.
Status: Proposed.

BITUMINOUS OIL PIPELINE CO. (Royalite Oil Co., and Can-Amera Oilsands Development, Ltd.)
Project: A 250-mile line from Athabasca oil sands to Edmonton..
Status: Proposed.

INDEPENDENT PIPE LINE CO. (Home Oil Co.), Calgary.
Project: 1,073 miles of 36-in. from Edmonton, Alta., to Superior, Wis.; 946 miles of 34-in. from Superior to Montreal, Que.; 72 miles of 16-in. and 74 miles of 10-in. feeder lines from Calgary to Bellshill Lake, Alta.
Status: Proposed.

MATADOR PIPE LINE CORP., Denver.
Project: 175-mile line from Burke, Bottineau, and Renville counties, North Dakota, to Cromer, Man.
Status: Proposed. (See U. S.)

MID-CONTINENT PIPE LINES, LTD., Edmonton, Alta.
Project: 1,500 miles of 30-in. from Edmonton to Chicago. U. S. section to be owned by International Oil Pipeline Corp., New York City.
Status: Pending Canadian Board of Transport Commission approval. W. C. Gilman & Co., New York City, has made preliminary study.

NORTHERN PIPE LINE CO., 30 Broad St., New York 4, N. Y.
★ Project: Line from Regina, Sask., to Clearbrook, Minn.
Status: Proposed.

PEACE RIVER OIL PIPE LINE CO., LTD., Calgary, Alta.
Project: 233 miles of 8-in. from the Milligan Creek area of British Columbia to Trans Mountain Pipe Line in Alberta.
Completion: Possibly in the fall 1960.
Project: 8 miles of 6-in., 45 miles of 8-in., and 17 miles of 12-in. from its Fox Creek Pump Station to Windfall, Virginia Hills, and Swan Hills fields in Alberta.
Status: Approved.

PEMBINA PIPE LINE, LTD., Drayton Valley, Alta.
★ Project: 70 miles of 3 to 10-in. gathering lines in Pembina field.
Contractor: Mannix Co., Ltd., Calgary.
Completion: December 15, 1960.

RANGELAND PIPE LINE CO., Calgary.
Project: 111-mile line from Cessford field to Calgary.
Status: Pending approval of Alberta government.

TRANS-PRAIRIE PIPELINES, LTD., Edmonton.
Project: 6-8-in. line from Weyburn field to Regina and Moose Jaw, Sask.
Status: Proposed.

Canadian Products Pipelines

BRITAMOIL PIPE LINE CO., LTD., Box 130, Calgary, Alta.
Project: 126-mile line from Pincher Creek to Calgary.
Status: Pending approval of the Alberta Oil and Gas Conservation Board.
Project: 64-mile line from Dick Lake to Edmonton, Alta.
Status: Pending approval of the Alberta Oil and Gas Conservation Board.

FOOTHILLS PRODUCTS PIPE LINE LTD., (Pembina Pipe Line Co., Mannix Co., Ltd.), Calgary, Alta.
Project: 1,300 miles of 16-in. from Alberta to the Great Lakes area.
Status: Proposed.

HUGHENDEN PIPELINE (c/o British American Oil Co., Ltd., 800 Bay St., Toronto).
★ Project: 125 miles from Dick Lake gasoline plant to underground storage in the Hughenden region of eastern Alberta.
Status: Pending approval of Alberta Oil and Gas Conservation Board.

WESTALTA PRODUCTS PIPELINE, LTD., (Pembina Pipe Line, Ltd., Edmonton, Alta.).
Project: Gathering system to take natural-gas liquids from plants in Alberta for delivery to proposed trunkline to Great Lakes area.
Status: Pending approval of Alberta Board of Public Utility Commissioners.

Canadian Natural Gas Pipelines

AJAX ALBERTA PIPELINE, Ltd., Derrick Building, Calgary.
★ Project: 28 miles of 10-in. and 4 miles of 8-in. from Morinville to Westlock Viking Sand field.
Status: Planned.
Completion: By September 1961.

ALBERTA GAS TRUNK LINE CO., LTD., Calgary.
Project: 256 miles of 36-in., 75 miles of 30-in., 55 miles of 26-in., 199 miles of various diameter gathering lines, and 42 miles of 16-in. delivery lateral. Main line is from Berland River, Alta., to Crows Nest Pass.
Status: Approved by the Alberta and Canadian governments. Has FPC examiner's approval.
Project: 72 miles of 24-in., 10 miles of 12-in., 24 miles of 6-in., and 2 miles of 4-in.
Contractor: Bannister Construction Co., Edmonton, has contract for 72-mile 24-in. main-line extension from Torrington to Rimbey, Alta.
Completion: 1960.

ALBERTA NATURAL GAS CO., LTD. (Pacific Gas & Electric Co., San Francisco, and Westcoast Transmission, Calgary).
Project: 108 miles of 36-in. across southeastern British Columbia to U. S. border near Kingsgate, B. C.
Status: Has Canadian and FPC examiner's approval.

BRITISH COLUMBIA ELECTRIC CO., Vancouver.
Project: 35 miles of 30-in. from Huntington, B. C., to Vancouver.
Completion: 1960.

CARTIER GAS CORP. (St. Maurice Gas, Inc. and Consumers' Gas Co., Toronto).
Project: 170 miles from Montreal to Quebec City.
Status: Proposed.

MAGNA PIPELINE CO., LTD., Nanaimo, Vancouver Island, B. C.
Project: 25 miles of 4.85-in. double flexible plastic pipe from Huntington, B. C., to Vancouver Island.
Status: Approved by British Columbia Public Utilities Commission. Tentative timetable calls for work to start by spring 1961.

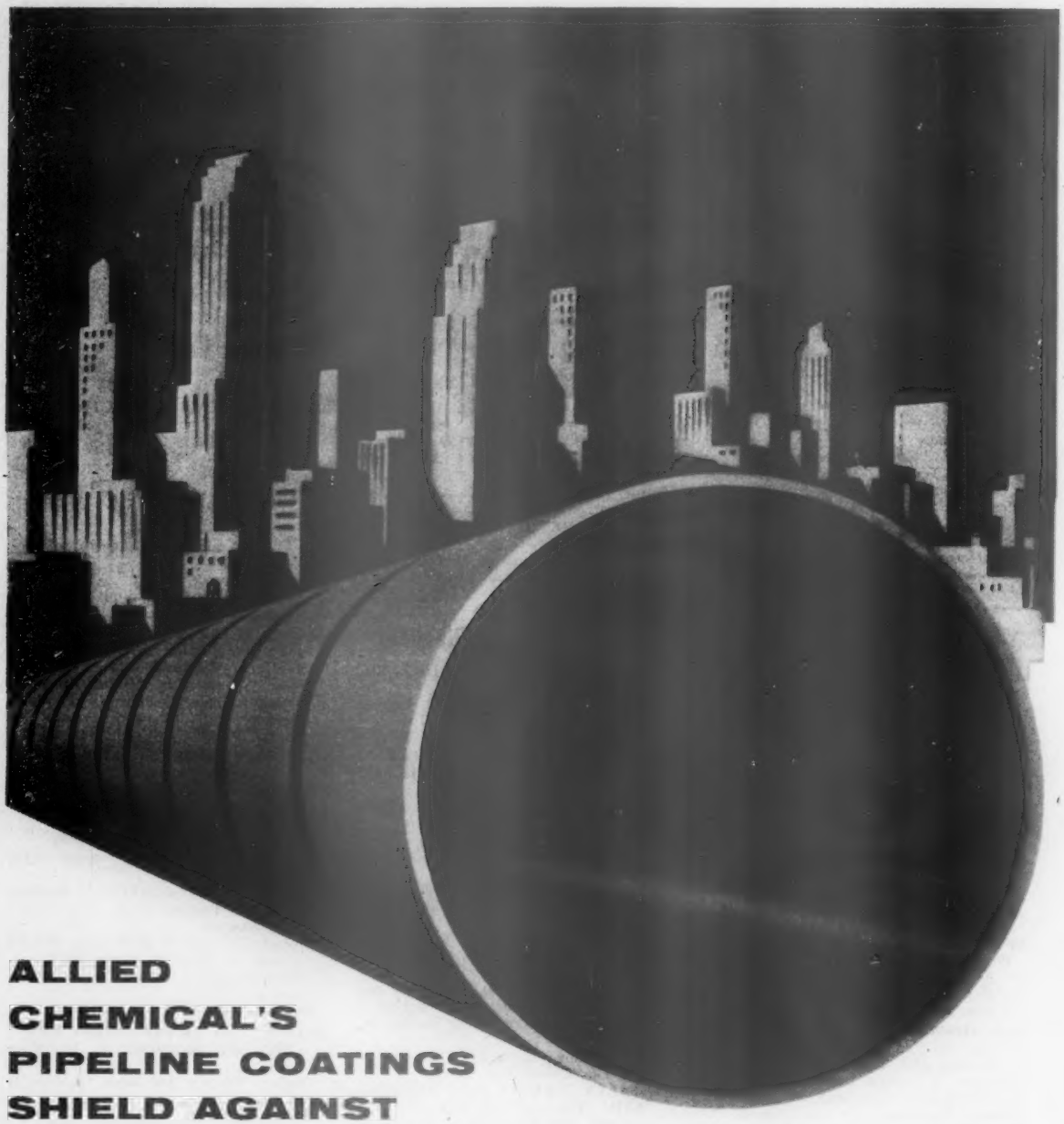
NORTHERN ALBERTA PIPE LINES, LTD., Edmonton, Alta.
Project: 110-mile trunk line, plus gathering system, from Lac La Biche, in McMurray vicinity, to Edmonton.
Status: Pending provincial approval.

NORTHERN NATURAL GAS CO., Omaha.
Project: 73 miles of 20-in. from Savanna Creek to Pincher Creek, Alta.
Status: Planned.
Project: 32 miles of 24-in. from Pincher Creek to Montana border to tie in with planned U. S. line on to Minneapolis.
Status: Planned.

QUEBEC GAS TRANSMISSION LINES, INC., 1610 Sherbrooke St. W., Montreal.
Project: 300-mile line from Montreal to Quebec City.
Status: Proposed.

SASKATCHEWAN POWER CORP., 1739 Cornwall St., Regina, Sask.
Project: 179 miles of 4, 6, and 8-in., in addition to distribution lines and laterals.
Completion: 1960.

TRANS-CANADA PIPE LINES, LTD., Toronto.
Project: 74 miles of 34-in. main-line loop (Burstall to Winnipeg, Man.) and 51-mile 30-in. lateral from Emerson, Man., to U. S. border near Noyes, Minn., to connect with proposed Midwestern system now before U. S. FPC.
Status: To start spring 1960.
Completion: Fall 1960.
Project: An additional 390 miles of 34-in. main-line loop between Burstall and Winnipeg, Man.
Status: Planned. About 268 miles scheduled for construction in 1961, and 122 miles in 1962.



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PIPELINE CONSTRUCTION

VAN TOR OIL & EXPLORATION CO., Vancouver, B. C.
Project: Line from British Columbia mainland to Vancouver Island.
Status: Proposed.

WESTCOAST TRANSMISSION CO. LTD., Calgary.
Project: (See Alberta Natural Gas Co., Ltd., for joint project).
Project: 250 miles of 30-in. from Taylor to Fort Nelson, B. C.
Status: Planned.

Foreign Crude Oil Pipelines

ABU DHABIE MARINE AREAS, LTD. (partly owned by British Petroleum Co., Britannic House, Finsbury Circus, London E.C. 2).
★ Project: 20 miles from offshore Persian Gulf pool to Das Island.
Completion: 1962.

ARAB PIPELINE.
Project: 1,250-mile pipeline from the Persian Gulf to Mediterranean.
Status: Proposed by Saudi Arabian Government and approved by the Arab League's petroleum department.

ARABIAN AMERICAN OIL CO., Dhahran, Saudi Arabia, and 505 Park Avenue, New York.
Project: 63 miles of 30-in. from Khursaniyah pump station to Ras Tanura,
Status: Planned.
Contractor: Company personnel.
Completion: 1962.
Project: 1¼ miles of 24-in. from Khursaniyah separator plant to pump station.
Status: Under way.
Contractor: Company personnel.
Completion: Third quarter 1960.
Project: 18 miles of 34 and 36-in. from Qatif to Ras Tanura.
Status: Under way.
Contractor: Company personnel.
Completion: Third quarter 1960.
Project: 4 miles of 14-in. from Abqaiq separator plant No. 3 to QA-2 line.
Status: Planned.
Contractor: Company personnel.
Completion: Third quarter 1960.

BARNABO GROUP (Italian interests).
Project: A line from Venice, Italy, to Innsbruck, Austria, which could then be extended to Munich, Germany.

BASRAH PETROLEUM CO.
Project: 65 miles of 30 and 32-in. from Zubair to Fao in southern Iraq.
Contractor: Turriff-Burden, Ltd., Tulsa.
Completion: 1961.

BOLIVIA-PARAGUAY.
Project: 500 miles of 6-in. from Southeast Bolivia to a proposed refinery on Paraguay River, and later to Asuncion.
Status: Planned.

CIE. DES TRANSPORTS PAR PIPE-LINES AU SAHARA (subsidiary of Cie. de Recherches et d'Exploitation de Petrole au Sahara), Paris.
Project: 420 miles of 24-in. from Edjele fields in Sahara to the Tunisian Mediterranean Coast.
Contractors: Groupement des Societes Entrepose et Parisienne pour l'Industrie Electrique en vue de l'Etude et de la Construction de Pipe-Lines, and Ste. des Grands Travaux de Marseille. Engineering firm on the job is Bechtel Mediterraneenne S. A.
Completion: October 1960.

CREOLE PETROLEUM CORP., Caracas.
Project: About 8 miles of 12, 20, and 24-in. gathering line in Lake Maracaibo.
Status: Planned.
Completion: December 1960.

EASTERN BLOCK COUNCIL FOR MUTUAL ECONOMIC AID.
Project: 2,500-mile "Vomecon" pipeline from the Volga-Ural oil fields in Russia to East Europe satillites.
Status: Construction under way in Czechoslovakia, with completion of this section by early 1961.

ELBURZ OIL CORP.
Project: 1,000 miles of 38-in. to move Qum crude to the Mediterranean.
Status: Proposed.

ENI Italian state oil agency) and **ITALO-SWISS FINANCE CO.**
Project: A 700-mile system from Genoa to Aigle, Switzerland, thence northeast to the German border, where it would split with one branch going to Munich and another branch to the Karlsruhe area. Feeder lines would go to Turin, Milan, and Cremona, Italy.
Status: The trunk line from Genoa to Aigle approved by the Italian Government.

ESSO STANDARD (LIBYA), INC.
Project: 100 miles of 30-in. from Zelten field to Gulf of Sirte.
Status: Pipe ordered.

IRANIAN OIL PARTICIPANTS, LTD.
Project: 30 miles of 20-in. and 22 miles of 16-in. looping of Agha Jari to Bander Mashur line.
Status: Planned.

IRAQ PETROLEUM CO., LTD., 214 Oxford Street, London, W. 1.
Project: 44 miles of 32-in. in Iraq, 21 miles of 24-in. in Syria towards Banias, and 38 miles of 30-in. in Syria and Lebanon toward Tripoli.
Status: Under way.
Contractor: Turriff-Burden, Ltd., Tulsa.

OASIS OIL CO. OF LIBYA, 539 South Main Street, Findlay, Ohio.
★ Project: 100 miles from Libyan production to Mediterranean Coast.
Status: Proposed.

OIL INDIA PRIVATE LTD. (Burmah Oil Co. and Assam Oil Co., two-thirds, and India Government one-third).
Project: 720 miles of line in northeast India. This would include 260 miles of 16-in. from Nahorkatiya to Noonmati and 460 miles of 14-in. from Noonmati to Barauni.
Contractors: Mannesmann, a German firm, will lay the 260-mile 16-in. system. Contract for the 460-mile 14-in. line has been awarded to Hindustan Steel, Ltd.
Completion: The 16-in. system is scheduled for completion in March 1961.

PETROLEO BRASILEIRO S. A. (Brazil).
★ Project: 250-mile line from Rio de Janeiro to Belo Horizonte refinery site.
Status: Petrobras will invite bidding from companies who have submitted tenders.
Project: 35 miles of 8 to 12-in. pipe from Buracica to Candeia.
Contractor: Techint, Inc., Milan, Italy.
Project: 80 miles of 24-in. to tie in to proposed Caxias refinery near Rio de Janeiro.
Status: Planned.

ROTTERDAM-RHINE PIPELINE CO. (N. V. Rotterdam-Rijn Pijpleiding Mij., owned 40% by Royal Dutch-Shell, 20% by Caltex, and 40% by Galsenberg & Mobil Oil Sales & Distribution Co.)
Project: 183 miles of 24-in. from Pernis, the port of Rotterdam, extending to Venlo, Holland, where it branches into one line to Wesel and a second to Godorf and Wesseling, Germany.
Status: Under way.
Contractors: Bechtel International Co. is construction manager of the project which is being constructed by a group of Dutch and German contractors.
Completion: June 5, 1960.

ROYAL DUTCH-SHELL.
Project: 12-mile line from Gore Bay, Australia, to Royal Dutch-Shell's Clyde refinery.
Status: Planned.
Project: 161 miles 20-in. line from Tandzung field to Balikpapan refinery, Borneo.
Status: Planned
Contractor: Williams Brothers Overseas, Ltd., Tulsa, and John Brown, Ltd., London.
Completion: January 1, 1962.

SHELL-BP PETROLEUM DEVELOPMENT CO. OF NIGERIA, LTD., 38/39 Marina, Lagos, Nigeria.
Project: 18 miles of 12-in. line from Port Harcourt to Bonny, Nigeria.
Status: Under way.
Constructor: African Construction Co.

SOUTH EUROPEAN PIPELINE CO. (Jersey Standard, Caltex, Shell, British Petroleum, and 12 other firms.)
Project: 419 mile 30-in. line from Lavers, near Marseille, to Strasbourg, with 40-mile extension to Karlsruhe, Germany.
Status: Construction to get under way by January 1961.
Completion: 1962.

SUPERIOR OIL CO., Los Angeles.
Project: A 16 and 24-in. line from its Lake Maracaibo, Venezuela, production to shore.
Status: Planned.
Contractor: Pipe Line Technologists, C.A., Maracaibo, has design.

SYRIAN PIPELINE, Damascus.
Project: 500-mile line from Karshuk field, Syria, to Mediterranean.
Status: Proposed.

UNION OF SOVIET SOCIALIST REPUBLICS.
Project: 2,315 miles of 28-in. Trans-Siberian crude-products line from Ufa and Tuimazy fields in Bashkiria to Irkutsk.
Status: Under way.
(See Eastern Block for information on new East Europe line).

YACIMIENTOS PETROLIFEROS FISCALES (Argentina), Buenos Aires.
Project: 390 miles of 14-in. from fields in Neuquen Province, Argentina, to Bahia Blancha.
Status: Bids requested.
Project: 625 miles of 12-in. from Mendoza to San Lorenzo.
Status: Planned.

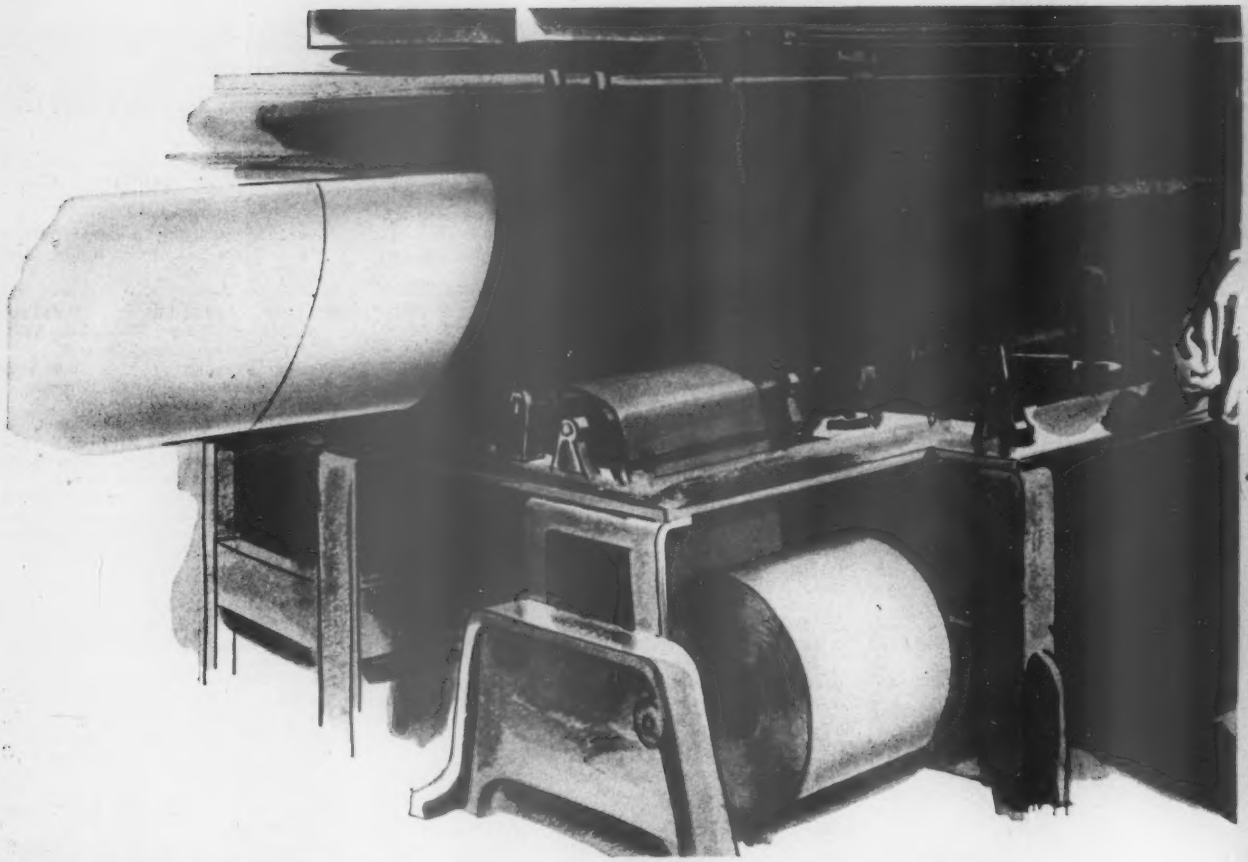
YACIMIENTOS PETROLIFEROS FISCALES BOLIVIANOS, La Paz.
Project: 407-mile 12-in. line from Camiri to Sica Sica.
Status: Planned.

Foreign Products Pipelines

ARABIAN AMERICAN OIL CO., Dhahran, Saudi Arabia, and 505 Park Avenue, New York.
Project: 30 miles of 8-in. LPG line from Abqaik to 'Ain Dar.
Status: Planned.
Contractor: Company personnel.
Completion: 1961.

ESSO PETROLEUM CO., LTD., 36 Queen Anne's Gate, Westminster, London, S.W. 1.
Project: 70-mile ethylene line from the Fawley refinery to Severnside.
Status: Planned.

ESTRADA FERROVIARIA SANTOS A JUNDIAL, Sao Paulo, Brazil.
Project: 25 miles of 6-in. ethylene line from Cubatao to Rio Grande.
Status: Pending approval.
Contractor: Techint, Inc., Milan, Italy.



Specify Johns-Manville Partners in Protection for all your pipe– mill or field wrapped

J-M BLUE FLAG for enamel reinforcement

J-M ASBESTOS FELTS for a tough outer shell

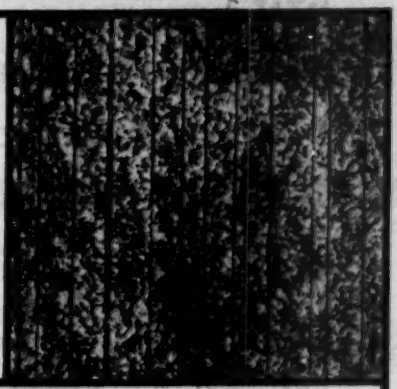
J-M FLEXIBLE ROCK SHIELD for added protection against hazards of rugged, rocky terrain

When you specify the Johns-Manville system of pipe protection, you're sure of the maximum security for your lines. Both J-M BLUE FLAG and J-M ASBESTOS FELTS are designed with modern, high-speed wrapping machinery in mind. And you get all these advantages:

- **TROUBLE-FREE APPLICATION**
  –no unusual or complicated requirements
  –long rolls of wrap mean fewer stops
- **PERMANENT BOND WITH THE PIPE**
  –no pressure-sensitive adhesive to deteriorate
  –no voids under spiral laps
  –no moisture migration
  –no "operating room cleanliness" of pipe required to secure a good bond

MEET 3 PARTNERS IN PIPELINE PROTECTION FROM JOHNS-MANVILLE

1



J-M BLUE FLAG Fiber Glass Wrap is a mesh of reinforced glass fibers that cannot rot, decay or absorb moisture under ground. Blue Flag lets enamel bleed through evenly until the wrap becomes an integral part of the coating. Uniform porosity prevents "holidays" as it assures consistent build-up.

2

J-M ASBESTOS FELTS, impregnated with either asphalt or coal-tar, are available in several weights to meet varied job requirements. These asbestos felts provide a flexible covering of stone, and have served as a tough outer shell on pipelines throughout the world.

3

J-M FLEXIBLE ROCK SHIELD is an asphalt-mastic composition board with a laminated felt surface. Its flexibility conforms to any pipe size, and its resilience provides the cushioning required in rugged rocky terrain.

● **DEPENDABLE RESISTANCE TO DAMAGE**
–during handling
–during backfilling
–throughout the life of the pipe, J-M Blue Flag plus J-M Asbestos Felts give proven protection against soil pressures and chemicals . . . assure successful, low-cost operation of cathodic protection

● **FOR UNUSUAL CONDITIONS**, there's one more J-M Product you can use–a *third partner in protection*–J-M Flexible Rock Shield. It cushions the lines against rock penetration during backfilling and in service. J-M Flexible Rock Shield provides more dependable, lower-cost protection than dirt-padding, and conforms readily to all pipe sizes.

For further details about Johns-Manville Pipe Wrap materials–*three partners in pipeline protection*–see your nearest J-M Representative, or write to Johns-Manville, Box 158, Dept. OG-530, New York 16, N. Y.

JOHNS-MANVILLE

JOHNS MANVILLE JM PRODUCTS

BLUE FLAG is a registered trademark of the Johns-Manville Corporation

"We were taking the plan for granted"

"You know, Ed, it's so easy to take these things for granted. I knew we'd put in the Payroll Savings Plan a long time ago. So I just assumed we had a good, sizable number of our employees who were buying U.S. Savings Bonds regularly.

"Well, last week our chairman asked me for the exact figures. When I checked up I found we had less than a third of our people making regular use of the Plan. We needed to have someone explain—in person—the convenience and soundness of this fine thrift program.

"I contacted our State Savings Bonds Director right away. With his quick, friendly help we set up a thorough canvass of everybody on the staff. We found that many of our company family were just waiting to have someone tell them how simple it is to share in this sound, systematic thrift plan. Then the polite suggestion, 'And why not start now?' really did the work. Today we have a participation we're proud of, and we're taking steps to increase it still more, every payday."

Experience of leading companies shows that spreading Payroll Savings information through the organization, person-to-person, results in quick increases in participation. And that brings such welcome benefits as lower employee turnover, better safety records and the keen satisfaction of helping your people to contribute to our Nations Peace Power.

ALL U.S. SAVINGS BONDS—OLD OR NEW—EARN ½% MORE THAN BEFORE

The Oil and Gas Journal
Tulsa, Oklahoma

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PIPELINE CONSTRUCTION

KUWAIT OIL CO., LTD., Burgan House, 105 Wigmore Street, London W. 1.
Project: 5½ miles of 12-in. to return product to reservoir.
Completion: Summer 1960.
Project: About 2½ miles of 8 and 12-in. at Shuwaikh depot.
Status: Under way.
Completion: Summer 1960.

NATIONAL IRANIAN OIL CO., Teheran.
Project: 510 miles of 8-in. from Teheran to Meshed, Iran.
Status: Under way.
Contractor: Williams Brothers, Tulsa, has contract for about half this project.

NORTH ATLANTIC TREATY ORGANIZATION (Bid details from Bureau of Foreign Commerce, U. S. Department of Commerce, Washington).
Project: 57 miles of 8-in. in Germany to Land Baden-Wuerttemberg air field.
Status: Planned.
Project: 93 miles of 6-in. in Turkey.

PETROLEOS MEXICANOS.
Project: 291 miles of 8-in. from Torreon to Chihuahua.
Status: Planned.
Completion: March 1961.

PIPELINES OF PUERTO RICO, San Juan.
Project: 95 miles 8-in. from Penuelas to Catano.
Status: Approved by Puerto Rican Public Service Commission.

SYRIAN PIPELINE.
Project: About 310 miles from Homs to tank farms in the Damascus, Aleppo, and Latakia areas.
Status: Bidding deadline past.

UNION OF SOVIET SOCIALIST REPUBLICS.
Project: 2,315 miles of 29-in. Trans-Siberian crude-products line from Ufa and Tuimazy fields in Bashkiria to Irkutsk.
Status: Under way.
Project: 700 miles from Novo-Kuibyshev refinery to Bryansk.
Status: Under way.

YACIMIENTOS PETROLIFEROS FISCALES (Argentina), Buenos Aires.
Project: 652 miles of 10-in. from Lujan de Cuyo to Buenos Aires.
Status: Planned.

Foreign Natural Gas Pipelines

CREOLE PETROLEUM CORP., Caracas.
Project: 18 miles of 30-in. and about 13 miles of 8 to 24-in. from stations in Bachaquero area to the Bachaquero compressor plant.
Status: Under way.
Completion: October 1960.

GASES NATURALES DE COLOMBIA, S. A. (owned 50% by Colombian Petroleum Co., which is affiliated with Mobil International and Texaco, and 50% by local interest.)
Project: 140 miles of 10-in. from Cicuco field to the Caribbean port of Barranquilla.
Completion: Late 1961.
Project: 75 miles from Rosh-Zohar field to Ashdod Yam.
Status: Proposed.

IRAQ GOVERNMENT.
Project: A natural-gas line from Rumaila oil field to Basrah.

MENE GRANDE OIL CO., Caracas.
Project: 19 miles of 12-in. from East Soto to Zapatos.
Completion: 1960.

PAKISTAN PETROLEUM CO.
Project: 145 miles of 8-in. from Sylhet field to Daccq, East Pakistan.
Status: Proposed.

PETROLEOS MEXICANOS.
Project. 483 miles of 24-in. from Jose Colomo field in State of Tabasco to Mexico City.
Status: Under way.
Contractors: Condusa is contractor. Contracts for eight river crossings awarded to Collins Construction Co., Port Lavaca, Tex., and Constructora Inde S. A. de C. V., Mexico City.
Completion: November 1960.
Project: 200 miles of 14-in. from Mexico City to Salamanca.
Status: Planned.
Completion: September 1961.
Project: 291 miles of 12-in. from Torreon to Chihuahua.
Status: Planned.
Completion: March 1961.

SN REPAL.
Project: 327 miles of 24-in. from Hassi R'Mel gas field in Algeria to the Mediterranean ports of Algiers and Oran.
Contractor: Groupement Enterpose-Ste. Parisienne pour l'Industrie Electrique (GREP) has contract for 200 miles from Hassi R'Mel to Tiaret.

STANDARD-VACUUM OIL CO., New York.
Project: 60 miles of 8-in. from Radja field to Palembang, Sumatra.
Status: Planned.

YACIMIENTOS PETROLIFEROS FISCALES (Argentina), Buenos Aires.
Project: Line from Comodoro Rivadavia to Buenos Aires with a spur to Plaza Huincul field in Neuquen province. Line will be 26 in. to the connecting point for the Plaza Huincul link and 30 in. from the connection to Buenos Aires.

New Edition Ready—

DIRECTORY

OF PLANTS AND PERSONNEL

The 1960-61 edition lists men in U. S., Canadian and Western European refineries and petrochemical plants. Also a complete listing of U. S. field processing plants. Gives more than 7,500 key personnel.

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- Summary of U. S. and Canadian Petrochemical Plants—Locations—Raw Materials—Key Personnel.

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▶ ▶ ▶ New Equipment Section

This week's SHOWCASE features . . .

Transistorized, remote time standard

A PORTABLE battery-powered time standard has been developed to provide a visual source of time, accurate to about ±16 seconds per year.

It can be used to control on-off operation, at precisely timed intervals, of recording instruments, telemetering equipment, and transmitters. It can be located in remote or isolated areas.

The instrument is completely transistorized, measures 7 by 11 by 7 in. in a handle-equipped case, and weighs only 9 lb., complete with batteries. The unit's transistor radio is a crystal-controlled, amplitude-modulated receiver using single conversion and 455 kc. IF. It is engineered to receive WWV, the National Bureau of Standards station, Beltsville, Maryland, and other accurate sources of "seconds tick," at any of three switch-selected frequencies, 2, 5, 5.0, and 10 mc.

Output of the receiver is fed to a decoder in its circuitry that filters out all information except the 1-second "tick." This is applied to a pulse generator that generates a pulse of the required amplitude and duration to synchronize the d.c.-operated clock. Delivery: 12 weeks to 4 months, depending upon quantity. Approximate list price, f.o.b. factory: $1,000. Source: **Zenith Radio Corp., 6001 West Dickens Avenue, Chicago 39.**

Digital sequential annunciator

. . . just disclosed clearly and instantly identifies the sequence in which a group of alarms occur, the maker says. It thus lets you identify off-normals instantly. Any number of total alarm points can be handled. Three variations are available whereby up to 7, 15, or 31 off-normal points may be sequentially identified by clear binary readout.

The Model 51-DS is especially valuable in monitoring complex industrial processes where any one or more of many factors can cause automatic shutdown. Alarms are audible as well as sequentially visible. After silencing the alarm horn, an operator may log off-normal sequence and press the reset button to clear the board of sequential identification lights. The board is then ready to record sequentially another series of alarms. Approximate net price, f.o.b. factory: less than $100 per point. Source: **Panalarm Div., Panellit, Inc., 7401 North Hamlin Avenue, Skokie, Ill.**

●

Slide rule

. . . and conversion tables have been combined in a handy tool now available. The Concise conversion tables and circular slide rule is specially designed for chemical and mechanical engineers and chemists. The slide rule has an outer circumference of 7½ in. and the C, CI, and D scales have as many subdivisions as a 10-in. straight slide rule. It also includes the A, K, and L scales.

The table of the elements and temperature conversion chart on the back plus the many conversion factors and much-used constants and data on the sliding insert make the tool handy for a number of operations.

It is made of polyvinyl chloride plastic, and the scales and tables are engraved. Shirt-pocket size, the slide rule comes with a case and instruction booklet. Price: about $3.50. Source: **Sama & Etani, 26 Medfield, Boston 15, Mass.**

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Product name, Model no., literature title or number: .....

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Described in OIL and GAS JOURNAL - Issue of May 30, 1960

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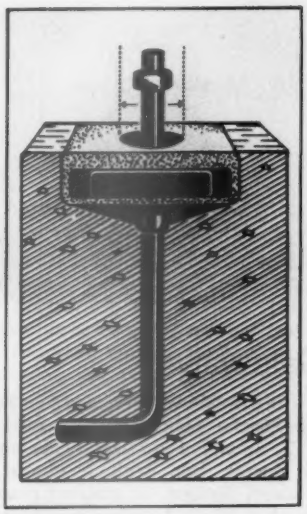

Anchor bolt

. . . cuts traffic hazards of protruding anchor bolts in new plant construction, according to the maker, as the Deco anchor bolt fitting remains flush with the floor until installation of equipment or column is made. An oblong nut within the fitting moves enough in all directions to compensate for the usual error in setting anchor bolts.

The machine or column is attached to the fitting by use of a stud of the desired length, thus avoiding the hoisting and lowering of machines over a fixed bolt by the trial-and-error method. Cast from high-strength malleable iron, the fitting is available alone or with an anchor bolt and stud to specifications in sizes from ⅜ to 1½-in. bolt diameters in ⅛-in. increments. Delivery: immediate. Approximate price, f.o.b. factory: from $3.65 for a ⅜-in. to $22.80 for a 1½-in. size. Source: **Decatur Engineering Co., 519 East William, Decatur, Ill.**

●

Slide rule

. . . aids pipeline design by making pipe weight and internal-pressure calculations easier and faster. The slide rule measures 3½ by 12½ in. and has 10-in. scales. It also permits a simultaneous conversion of pipe weight and pressure calculations from United States and British units to metric units.

The slide rule is divided into three parts. The first part enables you to find the weights of pipe made of steel, asbestos cement, aluminum, cast iron, brass, bronze, copper, and lead with diameters from ¼ to 60 in. and with wall thicknesses from 0.5 to 2½ in. The second part of the rule enables you to find the bursting, test, or working pressure, yield point, outside diameter, or thickness of any metal pipe. The test-pressure scale ranges from 50 to 20,000 psi. and the fiber-stress scale ranges from 1,000 to 200,000 psi.

The third part of the rule consists of a set of scales on which relative carrying capacities of pipes of different internal diameters can be found. The reverse side of the rule carries conversion tables and a set of schedule numbers of steel pipe dimensions to ASA Standard B 36.10. Source: **Intercontinental Enterprises, Financial Times New Building, Ground Floor South, 110 Queen Victoria Street, London, E. C. 4, England.**

●

Pump designed

. . . for oil-field use now on the market features a ductile-iron fluid end with a tensile strength of 30,000 psi. and 15% elongation; and a stainless-steel piston rod with a hard-chrome coating to not only resist corrosion but also to prevent damage to the packing from wire drawing. The rod packing is spring-loaded in deep stuffing boxes that have adjustable packing nuts.

The steel piston cylinder, covered with smooth noncorroding porcelain, is easy to replace or remove for inspection. The Model 7400 pump is a one-cylinder, double-acting, reciprocating type with a steel air chamber treated inside with an epoxy coating to resist corrosion. Other pump features include pinion gear and pinion machined from one-piece hardened high-grade steel, spring-actuated stainless-steel valves, and double ductile-iron crankshaft gears. Source: **Harley Sales Co., 619 South Main, Tulsa 19.**

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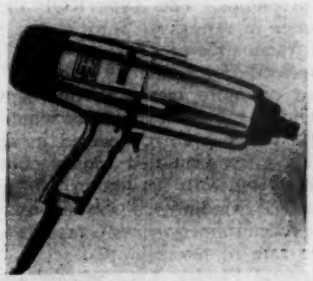


Stronger impact tool

. . . has resulted from the redesign of the maker's Size 8U heavy-duty electric Impactool. It now has 20% more power than the previous model, the maker says. The advantage over the older model is that the new one makes it possible to use it over long periods without undue fatigue.

The improved model is ¼-in. shorter, has a new easily replaceable socket retainer, Nylon trigger, and reinforced rubber-nosed hammer case. Weighing only 10 lb., the tool has a ⅝-in. square drive. Delivery: immediate. Approximate list price, f.o.b. factory: $220. Source: **Ingersoll-Rand 11 Broadway, New York 4.**

Crawler tractor operates easily

. . . as it is equipped with a "heel-and-toe" forward-reverse direction control, called a Hydro-Shuttle, that frees the operator's hands for full attention to operating the attached tools and steering. The control system along with the machine's dry type of torque convertor prevents engine stalling even under completely full load, the maker claims.

These features also permit fast and smooth work cycles.

Tradenamed the MoTrac, the 59-hp. crawler tractor comes in both diesel and gasoline-engine powered models. Both engine types are fully integrated with the five-speed transmission. Forward speeds range from 1.3 to 2.25 m.p.h. Source: **Minneapolis-Moline Co., Hopkins, Minn.**

Motor

... with built-in protection against overload is available for driving oil-well pumps. The Type KOF motor comes in ratings of 5 to 75 hp. and in frame sizes of 254U to 445U. The overload protection is provided by two or more miniature heat-sensing switches buried in the stator windings. The switches are connected in series with a conventional motor control. They shut off the motor whenever internal winding temperature exceeds a predetermined amount, regardless of the rate of temperature rise. Source: **General Electric Co., Schenectady 5, N. Y.**

●

Utility house

... can serve a number of purposes such as a portable field office or tool-shed. The Mirro portable utility house folds flat to 7½ in. by 4 ft. by 6½ ft. for easy carrying in a station wagon or trailer. It uses no nuts, bolts, screws, or nails. The maker claims two persons can set it up in a few minutes.

The portable unit is made of aluminum and requires no painting or maintenance. Delivery: immediate. Approximate net price, f.o.b. factory: $130. Source: **Mirro Aluminum Co., Manitowoc, Wis.**

●

Fuild cracking

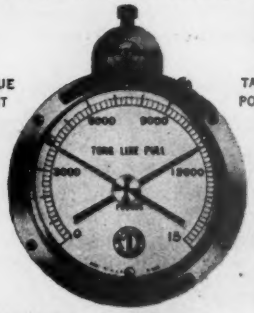
... catalysts recently developed are silica-magnesia-alumina compositions which, the maker reports, have selectivity advantages over current silica-alumina catalysts. Tradenamed Aerocat 3C-12 and 3C-20, the catalysts reportedly have catalytic activity and physical properties essentially the same as synthetic silica-alumina compositions. The maker claims that Aerocat 3C-12 produces an appreciably higher yield of gasoline of equivalent quality to that produced with silica-alumina catalyst and that Aerocat 3C-20 produces substantially increased yields of propylene and butylenes at the expense of coke and light gases. Source: **American Cyanamid Co., 30 Rockefeller Plaza, New York 20.**

Gate valve

... for 1,000-psi. service tradenamed the Demco 1000-Series, is available in 2, 3, and 4-in. sizes made either of ductile iron with a choice of screwed, flanged, or grooved connections or of steel with weld-end connections. Features include spread-ring seat construction, easy operation under pressure, fast opening and closing, and a simple inspection and parts-replacement operation. According to the maker, the valve has proven dependable against the high abrasive content of drilling mud and is being applied to several oil-production uses. Source: **Drilling Equipment Mfg. Co., Box 4728, Oklahoma City.**

TONG TORQUE

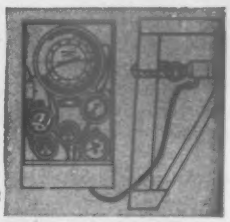
The Martin-Decker
TONG TORQUE ASSEMBLY
For All Connections



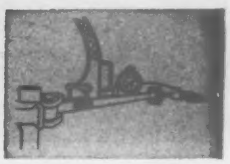
ONE GAUGE for torque measurements of all size drill collars, drill pipe, tubing and casing.

ACCURATE AND RELIABLE readings with calibration checks seldom required.

CARE AND MAINTENANCE can be capably done by the drilling crews.



PERMANENT INSTALLATION
The cylinder attached to the back-up line provides torque indication each time collars are run.



PORTABLE INSTALLATION
The torque assembly attached to the tong itself can be used for spot checks on two or more rigs.

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1960-61 DIRECTORY

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SHOWCASE . . .

New Literature

Centrifugal

. . . and turbine pumps with capacities from 1 to 9,000 g.p.m. and heads to 600 ft. are detailed in a new condensed bulletin. Illustrated and described are single and multiple-staged, flexible and close-coupled, and horizontal and vertical pump types. The literature piece also offers descriptions, features, typical applications, capacity, and head range for each type of pump. Source: **Aurora Pump Div., New York Air Brake Co., Aurora, Ill.**

Basic data

. . . for manual hardsurfacing is contained in new Bulletin 3100.1, which discusses the economics and metallurgy of hardsurfacing; analyzes various conditions which demand surfacing; and provides information on electrode selection and procedures which will produce the type of surfacing desired. Source: **Lincoln Electric Co., 22801 St. Clair Avenue, Cleveland 17.**

Gas-detectors

. . . which are portable, semiportable, and multichannel units are described in a new bulletin. Featured are advantages such as probe-type elements, nonelectronic circuits, lack of sampling systems, and initial low cost. Bulletin 510-1 offers general discussion of the principle and simplicity of a hot-wire platinum-element detection system. A chart of lower explosion limits of common gases gives values for reference. Source: **Houston Instrument Corp., P. O. Box 22234, Houston 27.**

Steel pipe couplings

. . . and pipe bulletin gives sizes, lengths, threads, weights, and carton contents of merchant, half, and API line-pipe couplings. It includes specifications on steel pipe. The illustrated, four-page brochure also lists conventional, extrastrong, double-extrastrong, and structural pipe. Source: **Wheatland Steel Products Co., Bankers Securities Building, Philadelphia 7.**

Filtration products

. . . are used for process fluids, internal-combustion engines, hydraulic fluids, machine-tool coolants, bulk fuel, and other applications. In 16 pages, the new publication covers explanation of flow rate, degree of filtration, viscosity of fluids, and reliability for various filtration media. Source: **Purolator Products, Inc., Rahway, N. J.**

Pressure

. . . and temperature recorders Catalog 800 (eight pages) pictures spiral bourdon tube and bellows-type pressure elements and lists materials and performance characteristics. Temperature elements described include the following types of actuation: mercury, vapor pressure, gas pressure, and organic liquid. A table lists thermal-element characteristics for each type. Photos highlight mechanical construction features. The catalog includes diagrams showing case dimensions, plus details of pressure and temperature connections. Source: **U. S. Gauge Div., American Machine & Metals, Inc., Sellersville, Pa.**

Unit-pumpers booklet

. . . featuring seven recently added sizes is complete with rating charts, dimensions, and specifications. Illustrations include new design features,

THE TREND IS UP
when you use
McKISSICK
THE BEST SNATCH BLOCK FOR YOUR PURPOSE
FROM McKISSICK'S FAMILY OF CHAMPIONS
4 to 40 Tons working capacities
4½ to 18" Diameter Steel Sheaves
Swivel Hook or Swivel Shackle
Drop forged, Heat treated, Swivel Hooks, Yokes & Shackles.
Be Specific, get McKissick
THE SUPER
THE HEAVY
McKISSICK PRODUCTS CORPORATION

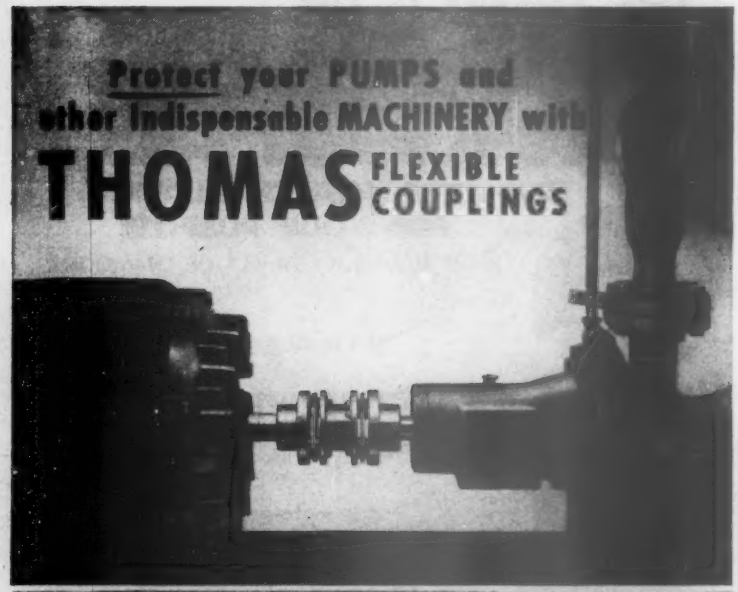
one-man counterbalancing method, and typical prime-mover mountings. The literature piece also presents information on load-multiplication factor and its effects on power costs and wear. Source: **Continental-Emsco Co., 608 Continental Building, Dallas 1.**

Induction-motors

. . . literature just made obtainable is designed to serve as a selection, application, and buying guide for single and three-phase motors from ¾ to 150 hp. This 14-page publication (Bulletin GEC-1049) offers: (1) an application chart which gives types recommended for various loads and ambient conditions; (2) tables listing dimensions, prices, characteristics, performance data, ordering instructions, modifications, and accessories; and (3) data on typical ratings and construction features. Source: **General Electric Co., Schenectady 5, N. Y.**

General catalog

. . . lists fishing tools, subsurface accessory tools, drilling and milling tools, remedial tools, and equipment for drilling and servicing. Source: **Bowen Itco, Inc., P. O. Box 4587, Houston 13.**



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Future maintenance costs and shutdowns are eliminated when you install Thomas Flexible Couplings. These all-metal couplings are open for inspection while running.
They will protect your equipment and extend the life of your machines.
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- Torsional Rigidity
- Free End Float
- Smooth Continuous Drive with Constant Rotational Velocity
- Visual Inspection While in Operation
- Original Balance for Life
- No Lubrication
- No Wearing Parts
- No Maintenance

THOMAS FLEXIBLE COUPLING COMPANY
WARREN, PENNSYLVANIA, U.S.A.

Handbook

. . . on Viton O-rings as high-temperature seals has just been published. The 24-page handbook 5711 contains test information on some 150 fluids and gases with which Viton O-rings are compatible; recommended O-ring and groove design techniques; general information on three Viton O-ring compounds and dimensions; and data on O-ring sizes. Source: **Parker Seal Co., 10567 Jefferson Boulevard, Culver City, Calif.**

Solid-State

. . . Conversions is the title of a new illustrated technical booklet, yours upon request. Among categories discussed are a.c. and d.c. voltage-level-sensing systems, static inverters, power supplies, ice-detection systems, and solid-state components. Source: **Diaphlex Div., Cook Electric Co., 2700 Southport Avenue, Chicago 14.**

Fluid, Fluent Communications

. . . is the title of a new 12-page booklet which emphasizes the importance of communications in today's business world. It points out how one's success depends to a large extent on his ability to communicate effectively with his employers, employes, and colleagues. The booklet outlines pitfalls and dangers of improper communications and suggests many short cuts you may use to improve your ability to communicate fluidly and fluently. Source: **Heat Exchanger Div., Western Supply Co., P.O. Box 1888, Tulsa.**

General oil-field

. . . equipment is outlined in new 48-page Brochure 2980 now available. Included are: chains and sprockets; couplings and bearings; complete drives; shale shakers; and shovels, cranes, draglines, hoes, and sea cranes. Source: **Link-Belt Co., Prudential Plaza, Chicago 1.**

Pipe layer

. . . of 93 hp. called the 561 Series B is described in a 4-page booklet. It describes the specially designed diesel engine, a new oil clutch, a lifetime-lubricated undercarriage, high ground clearance, coordinated operator compartment, and various safety features. Lift capacity of the pipelayer using 5,000-lb. hydraulically adjustable counterweights is listed as 38,000 lb. Source: **Caterpillar Tractor Co., Peoria, Ill.**

▶▶▶ Equipment Men Notes

Eastman Oil Well Survey makes

. . . six appointments in the company's Gulf Coast directional-drilling and service staff. Sidney J. Naquin heads the Eastman Louisiana district office. He resides in Lafayette.

S. J. Naquin

J. C. Staton is now manager of the Eastman Houston office, serving the Texas Gulf Coast. Francis N. LeBlanc heads the

J. C. Staton

F. N. LeBlanc

Gulf Coast oil-well-surveying department and directional-drilling planning staff. He also headquarters in Lafayette.

Other appointments include: J. R. Sandifer, area directional-drilling field supervisor; Darrell Patrick, Houston district sales; and John Prestridge, Jr., Gulf Coast sales.

Hale Mfg. Co., appoints pair

. . . to new division sales manager positions. R. K. Cooper has been named northern division sales manager with offices in Tulsa, and B. J. Smith becomes sales manager for the southern division with headquarters in Houston.

Both men joined the company 2 years ago and have been in the oil-field-supply business for about 10 years. Cooper was formerly Hale's sales representative in the Rocky Mountain area. Smith held a similar post in Houston.

Dowell expands operations

. . . in the Pennsylvania and New York oil and gas areas by opening a service headquarters in Punxsutawney, Pa., according to L. J. Kutlich, manager in the division's eastern area. Howard Waugh has been transferred from Charleston, W. Va., to be manager of the new office.

D. L. Brehm and B. L. Chisler have joined the office as service sales engineers from Flora, Ill., and Killbuck, Ohio. Office clerk is J. L. James, who was transferred from Mt. Carmel, Ill. R. W. Vutech has been shifted to Charleston from Hobbs, N. M., to succeed Waugh.

Continental-Emsco Co. reports

. . . several promotions and transfers. Robert J. Grigsby has been promoted from D+B specialist to store manager in New Harmony, Ind. Grigsby began his employment in 1952 as a warehouseman. He has also been a field salesman.

Also promoted to store manager is Leroy E. Fullingim, Luling, Tex. Fullingim started with C-E as a sales trainee in 1948. He has also served as a D+B storeman, service engineer, field salesman, and D+B specialist.

Raymond M. Lewis, former field salesman, is now D+B specialist in Sundown, Tex. Richard E. Walker has been promoted from a field salesman to D+B specialist in Newcastle, Wyo. And Theodore D. Phillips abandons his field-salesman post to become D+B specialist in Salem, Ill.

Three D+B specialists have been transferred to new assignments. Chris W. Banks, from El Dorado to Ellinwood, Kans.; Clarence R. Barta, from Ellinwood to Liberal, Kans.; and Miller F. Moffett, from Freer to Alice, Tex.

Chemetron Corp. plans to buy

. . . Clyde Tube Forgings Ltd., Glascow, Scotland, a manufacturer of welding fittings for industrial piping and pipeline transportation systems. Chemetron's Tube Turns Division will coordinate Clyde Tube Forgings' operations with its own.

ENGINE POWER is the subject being discussed by Bill Jones, Caterpillar field representative; James Hoag, president of Ingersoll Corp.; Nick Wheless, of Wheless Drilling Co.; and Hugh Rose, Caterpillar Engine Division. The discussion took place in Shreveport recently at Ingersoll's open house which marked the corporation's appointment as Caterpillar engine dealer for Arkansas and northern Louisiana.

Six changes are announced

. . . by Victor E. Rennix, general sales manager of Electro-Motive Division of General Motors, La Grange, Ill. In the eastern region, Duane O. Brooks, Bruce C. Burdick, and Melvin A. Hiter have been named parts sales representatives. And Allan A. Michels has been appointed regional service manager replacing W. A. Turner who has retired. Burdick, Hiter, and Michels will be located in New York; Brooks at Jacksonville, Fla.

In the Chicago region, Henry M. Garvey has been named parts sales representative located in Chicago, and Ivan E. Rice will be parts sales representative in the San Francisco region locating there.

Promotion of F. G. Fabian, Jr.

. . . to the position of executive vice president of Dresser Industries, Inc., has been announced by H. N. Mallon, chairman of the board. Fabian has been president and general manager of Dresser Mfg. Division at Bradford, Pa. since 1955, 2 years after joining the organization.

F. G. Fabian, Jr.

Charles Kuhn

In his new post, Fabian will be responsible for operations of five oil-field divisions — Guiberson Corp., Ideco, Security Engineering, Lane-Wells, and Magnet Cove Barium Corp. Mallon also announced the promotion of Charles Kuhn, former vice president and sales manager of Dresser Mfg. Division, to president of the Bradford subsidiary.

Two store managers are named

. . . at two locations by Jones & Laughlin Supply Division. J. W. Crownover, Jr., former store manager at Edmonton, has been assigned a store-manager post at Worland, Wyo., and R. J. Farley, storeman-advanced at Edmonton, takes on Crownover's former job as store manager there.

Charles E. Wright transferred

. . . to Lafayette, La., where he will represent Ideco Division of Dresser Industries, Inc., announces Jack Hol-

der, Jr., domestic sales manager. Wright has been with Ideco since 1953. Prior to his assignment as a technical service representative last year, he was manager of pricing and specifications at the company's Beaumont plant.

E. H. Urquhart becomes

. . . a staff sales engineer for Texas Instruments Inc. Geosciences & Instrumentation Division's Instrumentation Product Group. He will provide service to customers in the fields of data recording, automation equipment, and control-systems instrumentation. Urquhart joined TI last year as a customer requirements engineer on Data-Gage liquid-level-measurement systems.

R. E. Hurst is given title

. . . of district technical manager of Dowell Division of The Dow Chemical Co., according to A. C. Polk, executive vice president and general manager. Hurst has been with Dowell since early in 1949. He has held responsible engineering positions with the division at various places, including the company's general office in Tulsa. He has also been selected to represent the company on several engineering assignments abroad. In his new position, Hurst will continue to make his home in Midland, Tex.

BREAKING GROUND for the multimillion-dollar engine-manufacturing plant being erected at Allis-Chalmers Mfg. Co.'s Harvey, Ill., Works, is L. C. Daniels, general manager of A-C's Engine-Material Handling Division. With him, from left, are: A. W. Van Hercke, director of engineering, Tractor Group, and a vice president of the company; William B. Kane, mayor of Harvey; John Ernst, general works manager, Tractor Group, and a company vice president; Owen J. Higgins, general manager of the works; E. J. Mercer, general manager, Construction Machinery Division, and an A-C vice president; and J. C. Baseheart, engine sales manager, Engine-Material Handling Division.

JUMBO TANK CAR with a capacity of 18,500 gal., is one of 50 such models delivered to Cities Service by General American Transportation Corp., of Chicago. The cars are used for transporting propane gas and also can carry anhydrous ammonia and other products that must be shipped under pressure. The cars permit Cities Service to take advantage of preferential freight rates for larger quantities. Loading and unloading time is reduced, chiefly because only half as many cars need be spotted, and loading and unloading devices are hooked up and removed only half as many times.

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. . . Luther R. Hill to assistant to the vice president of sales. A 23-year Kellogg employe, Hill more recently was a private consultant and process coordinator for Arthur G. McKee & Co. His new sales duties will be primarily concerned with the transition of research and development process results to commercial industrial applications.

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Century Geophysical inaugurates

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Republic Supply Co. appoints

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. . . Ben N. Hogan as manager of its Houston sales office, and John P. Rhodes as manager of its Dallas and Fort Worth area.

Hogan was formerly with Howard Supply Co. in California, Fluor Corp., and Fish Engineering. Since 1956 he has been manager of purchasing and administrative services for Pacific Northwest Pipeline Co.

Rhodes has been with Republic for 15 years. He has served as manager of the Oklahoma district and, for the past 2 years, as manager of the Houston office.

New big drilling barge ready

DRILLING BARGE in raised position.

A GIGANTIC drilling barge left Avondale Marine Ways, New Orleans, earlier this month for a trip down the Mississippi to the offshore waters of the Gulf of Mexico. There the barge will drill for the California Co. following a test period.

Designed to drill in water up to 100 ft. deep, Barge 66 is 217 ft. long, 117 ft. wide, and 14 ft. high in its upper portion. The lower section, which is a pontoon, is 184 by 117 ft. and is 8 ft. high. It contains a pump room, ballast tanks, and an elevator-equipped escape hatch.

When drilling in depths of 100 ft., the upper section will ride 50 ft. above the ocean surface. Complete facilities for 44 men are a feature of the vessel, along with a heliport.

It took six tugs to help it down the Mississippi River. In passing under the old Mississippi River Bridge at New Orleans there was only 20 ft. of clearance. While the tugs were holding the barge back against the river's current, the drilling platform was slowly eased under the old bridge. The brisk winds and tricky river currents made this an edgy feat. The pontoon was lowered 50 ft. below the water surface and the tops of the legs extended 100 ft. into the air.

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DEMCO "MUD KING"

The Industry's Finest Valve

For mud lines, sand-frac, cementing and other water, oil or gas services.

Sizes: 2, 3, 4 inches
2,000 lbs. W.P. (4,000 lbs. test)
3,000 lbs. W.P. (6,000 lbs. test)

AT SUPPLY STORES EVERYWHERE

DEMCO

For Helicopter Service Companies

IT'S A TRUCK

Sikorsky helicopters—hauling heavy equipment, parts, supplies and men right to the job—are working as trucks for: Okanagan Helicopters Inc., Petroleum Helicopters Inc., Rotor-Aids Inc., and Worldwide Helicopters Inc. Such companies lease Sikorsky helicopters to a wide range of industries to do a variety of trucking jobs. In a fraction of the time that it takes an on-the-road truck, and at less cost, helicopters deliver the goods.

Working as trucks, Sikorsky helicopters are busily engaged in oil exploration, pipeline and transmission line construction, geodetic surveys and cargo transfers.

For the Puerto Rico Water Resources Authority

IT'S A CRANE

In Puerto Rico, work crews for the Water Authority once needed three to four *months* to plant 100 transmission-line poles. Now, one crew plants 100 poles in *one day* with just one Sikorsky helicopter. "Without the helicopter, it used to cost as much as $380 to set a pole. With the helicopter working as a crane, costs have tumbled to $35 to $75 a pole," reports Rafael R. Ramirez, the Authority's assistant executive director.

As cranes, Sikorsky helicopters are solving costly, time-consuming problems everywhere with a new approach—from the air. The result: lower costs, higher profits.

For the Indiana Gear Works

IT'S A COMPANY CAR

At the Indiana Gear Works, a Sikorsky S-51 helicopter (the newer S-62, shown above, is now available) speeds management personnel from company offices to outlying plants, from plant to plant, and out to the airport. "The saving in executive hours is almost incalculable," reports one official. This not only means time saved, money saved, but *more business accomplished.*

As company cars, Sikorsky helicopters are also ferrying high-salaried personnel city to city, city to airport and company office to customer's office. Helicopters are freeing executive hours for more productive work.

Sikorsky helicopters did all these things first. Altogether, they do more of these jobs today than all other vertical lift aircraft. To learn how your company can gain from the work of a Sikorsky helicopter truck, crane or company car, write to Sikorsky Aircraft today.

A New World of Mobility by
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Stratford, Connecticut
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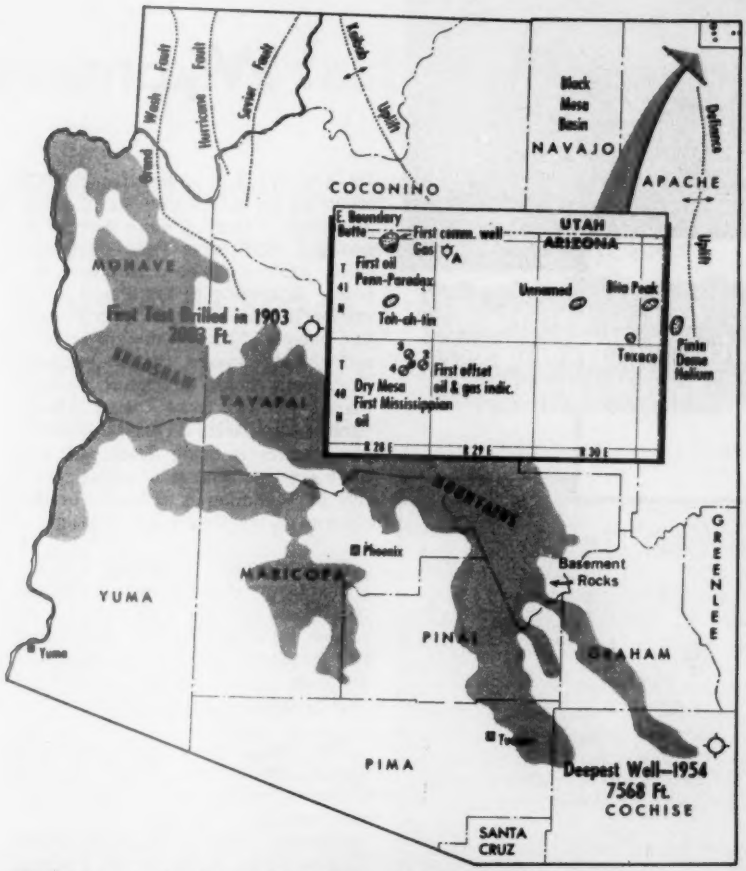

ARIZONA production is now limited to a single county—Apache. This vast area is virtually untested with fewer than 200 wells in 57 years.

Check Arizona—it could be a real sleeper

BY PETER B. BIKE

SUPPOSE YOU ARE an exploration manager whose immediate job at hand is to recommend an expansion program into new areas. How would you rate Arizona as a likely region? Good—or so-so? If it chills you, you'd better look at your hole card and here's why:

Don't let the record discourage you. All corners of this vast state have been probed to a minor extent during the past 57 years. Yet the drilling density is low and penetration depths are shallow.

Long time coming. Apache County is the only producing area, with oil and gas in the extreme northeast corner, and helium wells in the central sector. It all started in 1950 when high-percentage (7-8%) helium wells were found at the Pinta Dome of central Apache County.

It took until 1954 and an inspired operator to bring Arizona into the ranks of producing states. Early that year Shell Oil Co. drilled the 1 Navajo in 6-41n-28e, Apache County, which was completed as a Pennsylvanian gasser, but proved uncommercial later (A on map insert). Undaunted, Shell drilled the 2 East Boundary Butte later in the year, and this was a profitable venture, resulting in 3.15 M.M.c.f. of gas and 11 bbl. oil daily. Shell was probably the most undaunted operator in the field that year, having brought in first discoveries in three states (Nevada and South Dakota were the others).

Looking better. In 1955 Humble Oil & Refining Co. completed the 1 Navajo at East Boundary Butte for 8.2 M.M.c.f. gas and 47 bbl. 37.9° oil daily from the Hermosa section. Things were looking up the following year when El Paso Natural Gas Co. opened Bita Peak field with a flush initial flow of 20.8 M.M.c.f. gas with 1,000 bbl. of condensate daily from a lower Hermosa pay at 5,500 ft. This year of 1956 also saw Franco Western Oil Co. score at Toh-ah-tin, south of East Boundary Butte field, with a Pennsylvanian - Paradox pay. Well made 7.45 M.M.c.f. gas daily.

Humble raised the ante and the table stakes in Arizona were becoming more attractive following the discovery of a good Pennsylvania oiler at East Boundary Butte in 1958. Its E-1 Navajo was completed as the state's first oil well. Well made 1,044 bbl. at 4,600-75 ft. in the Hermosa. In 1958, Superior Oil Co. completed the 2 Navajo H in 16-41n-30e for 12.5 M.M.c.f. gas and 125 bbl. 64.6° condensate.

A new pay. Dry Mesa field was discovered in 1959 by Texas Pacific Coal & Oil Co. 1-138 Navajo in 11-40n-28e when the first Mississippian oil was encountered at 5,566-89 ft. Well made 240 bbl. oil and 43.8 M.c.f. gas daily. Currently the east offset is testing and it appears likely that more Mississippian oil will result. This test was drilled into the Precambrian at 5,771 ft. TD. Two more offsets, the 3 and 4, are staked and will be drilling shortly.

A well to watch is the Texaco Inc. 1 Navajo Z in 36-41n-30e southwest of Bita Peak. It has encountered several potential zones and at last report was testing the Devonian. In the Mississippian, it was reported that along with gas, commercial helium was found. The Devonian is a likely new pay for Arizona along with more Pennsylvanian and Mississippian oil. Texaco may convince the remaining doubting Thomases that Arizona is a good place to drill.

The best is yet to come. It's not likely that all of the state's oil and gas is limited to Apache County, nor to its northeastern sector. In the tests that have been dug over the state, many have had teasing shows of oil or gas. Simply, the drilling density and depth of penetration for the vast unproductive areas prove only one thing—absolutely nothing! Don't write off Arizona without a second look. There's a big pot at stake for the winners.

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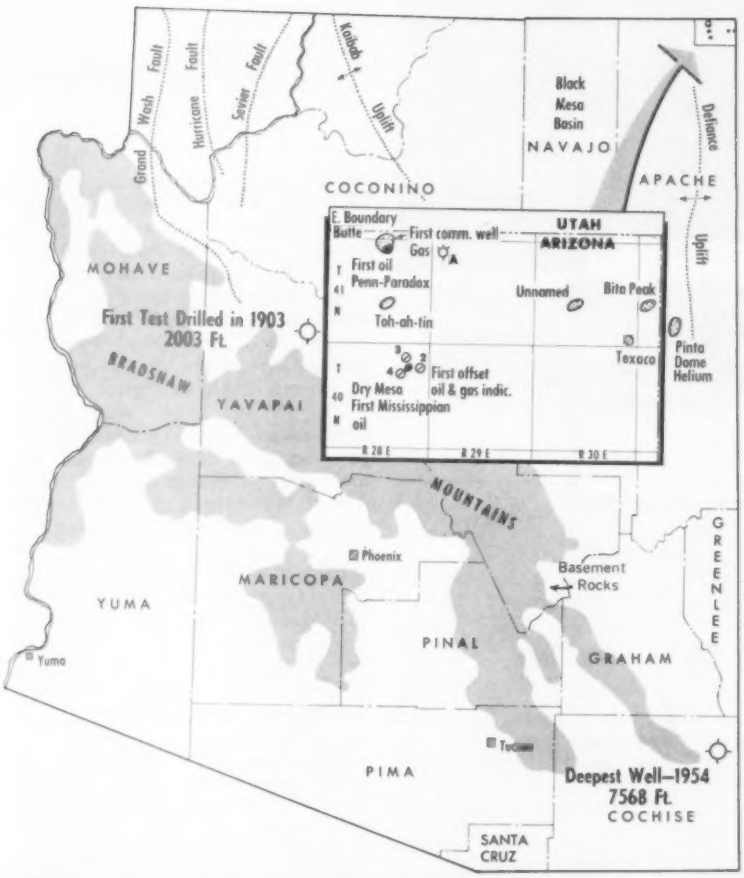

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It took until 1954 and an inspired operator to bring Arizona into the ranks of producing states. Early that year Shell Oil Co. drilled the 1 Navajo in 6-41n-28e, Apache County, which was completed as a Pennsylvanian gasser, but proved uncommercial later (A on map insert). Undaunted, Shell drilled the 2 East Boundary Butte later in the year, and this was a profitable venture, resulting in 3.15 M.M.c.f. of gas and 11 bbl. oil daily. Shell was probably the most undaunted operator in the field that year, having brought in first discoveries in three states (Nevada and South Dakota were the others).

Looking better. In 1955 Humble Oil & Refining Co. completed the 1 Navajo at East Boundary Butte for 8.2 M.M.c.f. gas and 47 bbl. 37.9° oil daily from the Hermosa section. Things were looking up the following year when El Paso Natural Gas Co. opened Bita Peak field with a flush initial flow of 20.8 M.M.c.f. gas with 1,000 bbl. of condensate daily from a lower Hermosa pay at 5,500 ft. This year of 1956 also saw Franco Western Oil Co. score at Toh-ah-tin, south of East Boundary Butte field, with a Pennsylvanian - Paradox pay. Well made 7.45 M.M.c.f. gas daily.

Humble raised the ante and the table stakes in Arizona were becoming more attractive following the discovery of a good Pennsylvania oiler at East Boundary Butte in 1958. Its E-1 Navajo was completed as the state's first oil well. Well made 1,044 bbl. at 4,600-75 ft. in the Hermosa. In 1958, Superior Oil Co. completed the 2 Navajo H in 16-41n-30e for 12.5 M.M.c.f. gas and 125 bbl. 64.6° condensate.

A new pay. Dry Mesa field was discovered in 1959 by Texas Pacific Coal & Oil Co. 1-138 Navajo in 11-40n-28e when the first Mississippian oil was encountered at 5,566-89 ft. Well made 240 bbl. oil and 43.8 M.c.f. gas daily. Currently the east offset is testing and it appears likely that more Mississippian oil will result. This test was drilled into the Precambrian at 5,771 ft. TD. Two more offsets, the 3 and 4, are staked and will be drilling shortly.

A well to watch is the Texaco Inc. 1 Navajo Z in 36-41n-30e southwest of Bita Peak. It has encountered several potential zones and at last report was testing the Devonian. In the Mississippian, it was reported that along with gas, commercial helium was found. The Devonian is a likely new pay for Arizona along with more Pennsylvanian and Mississippian oil. Texaco may convince the remaining doubting Thomases that Arizona is a good place to drill.

The best is yet to come. It's not likely that all of the state's oil and gas is limited to Apache County, nor to its northeastern sector. In the tests that have been dug over the state, many have had teasing shows of oil or gas. Simply, the drilling density and depth of penetration for the vast unproductive areas prove only one thing—absolutely nothing! Don't write off Arizona without a second look. There's a big pot at stake for the winners.

Wyoming

IN AN AREA of more than 200,000 adjoining acres in Sweetwater County, Southwest Wyoming, more than 53 oil and gas wells have been completed since 1958 with only a dozen dry holes. According to Petroleum Information in Denver, more than 10 million barrels of recoverable oil reserves are already proved in the booming Cretaceous fields of Desert Springs, Playa, Patrick Draw, West Desert Springs, and Arch. A vast blanket of gas reserves is being developed, and the biggest percentage of active rotary rigs in Wyoming is centered in this portion of the Green River basin.

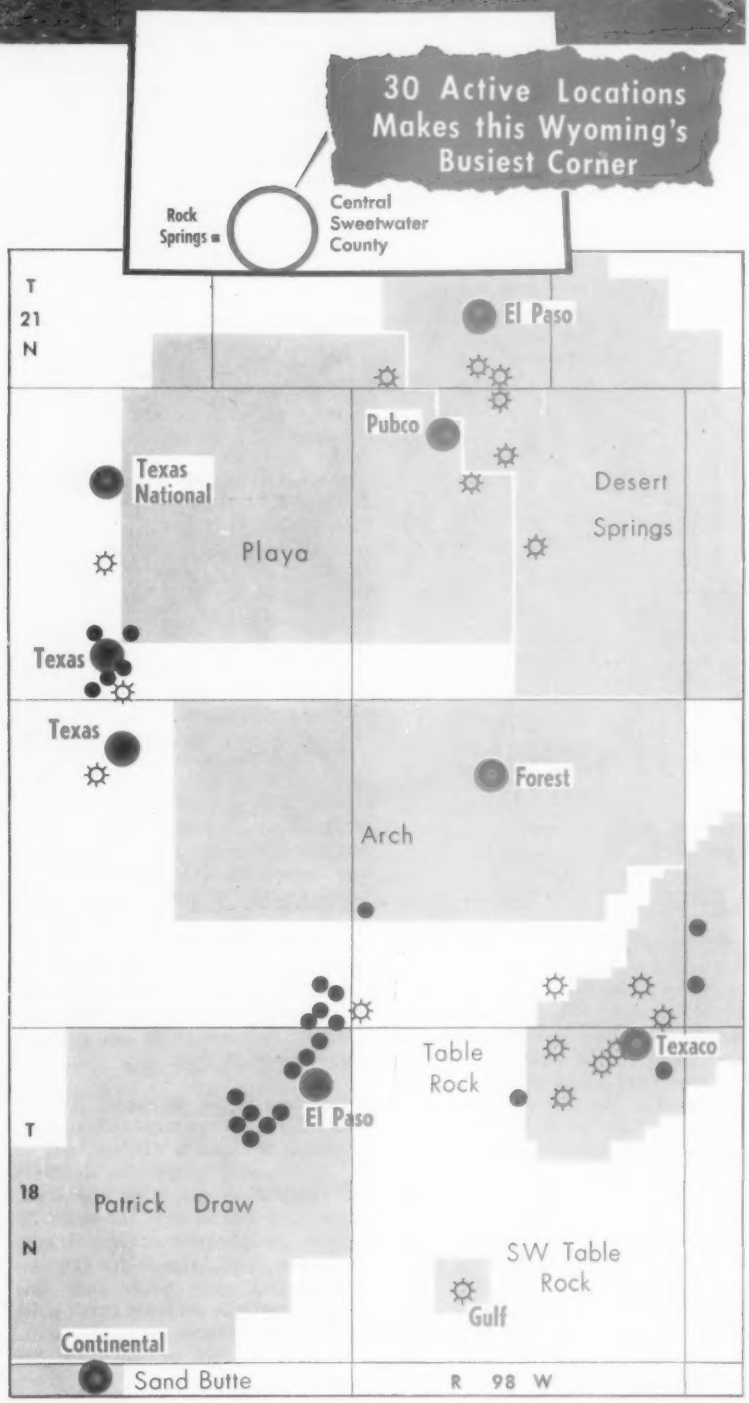
High promise. Everything is in the area's favor—big oil and gas potentials of more than 1,000 bbl. of oil and as much as 40 M.M.c.f.d., excellent transportation facilities, fast and relatively cheap drilling costs, and well-balanced lease situations.

The area. Seven units and one named area, West Desert Springs, comprise this fast-growing new oil and gas province. Units are Table Rock, Southwest Table Rock, Sand Butte, Patrick Draw, Arch, Desert Springs, and Playa. Most of the acreage is inside these units. However, recent drilling has tapped excellent oil and gas production outside the unit walls. The units involved cover 105,615 acres.

This oil and gas giant lies on the Wamsutter arch—an eastward-plunging nose that divides the Red Desert and Washakie basins, two of the three junior basins making up the entire Green River basin area.

The target. Mesaverde sands are the objective of current exploration and development. These sands were practically unknown to Wyoming producing circles until Desert Springs was opened 2 years ago. Now the Almond sand of the Mesaverde Cretaceous group is one of the most sought-after pays in the Rockies.

History. This portion of Green River basin came to life in 1946 at Texaco Inc. 1 UPRR in 1-18n-98w.



DISCOVERIES and development-well completions are dotting Sweetwater County's Patrick Draw area thick and fast.

action sets fast pace

Of the half-dozen most active areas in the nation today, the Patrick Draw and Desert Springs portion of the Rockies is one of the most promising. Here is an area that apparently can't miss in success.

Texaco got 5,615 M.c.f.d. from basal Wasatch Tertiary sands at this well, opening Table Rock field. Subsequent development opened production at seven gas wells and three oil producers. In 1955 Gulf Oil Corp. opened Almond gas production in the area at 1 Southwest Table Rock in 28-18n-98w. This well flowed 981 M.c.f.d., but is the sole producer there as of now. Too small Almond oil wells were added to Table Rock itself by Texaco in 1957.

The big push. Drilling got under way in earnest in 1958 when El Paso Natural Gas Co. found gas in the Mesaverde at Desert Springs. That well was considered one of the exploratory highlights of the year for the Rockies. The unit rapidly expanded south and north.

After the Desert Springs Unit discovery, drilling moved into the proposed Playa Unit which only this year was approved. The discovery well was Pubco 1-34 Unit in 34-21n-98w. It flowed 2,500 M.c.f.d. from Ericson Cretaceous at 4,778-92 ft. Then Almond gas came to the unit at 8-1 Unit in 8-20n-98w. That Pubco well flowed 40 M.M.c.f.d. from 5,503-22 ft., opening a new pay.

Then Patrick Draw. In 1959 El Paso opened Almond production at 1 Patrick Draw Unit in 1-18n-99w. This well fired a development program that has netted nine big oil wells inside unit confines, and five oilers and one gas well just to the north of the unit in the area between Arch and Patrick Draw—a gap that is fast closing. The second big success at Patrick Draw was a Texas National Petroleum Co. well, the 1 Government-Withers in 32-20n-99w. Both wells were flowing Almond oil producers. After the El Paso Natural Gas Co. discovery, El Paso Natural Gas Products entered the field. The confirmation well flowed more than 1,000 bbl. per day. Texas National also had big flowing wells in later development work.

Today the field remains undefined. Drilling is spreading northward at a rapid rate. The biggest wells are in this northern end of the field, most of them in 36-19n-99w. Here Gulf has five wells that flowed more than 900 bbl. daily.

There are eight oil wells for El Paso at Patrick Draw, one dry hole. Gulf has five oil wells, Union Pacific one. El Paso has 10 active locations, Gulf 2. The grand total for Patrick Draw, according to Petroleum Information, is 34 completions, drilling wells, or locations. One dry hole only is tallied. Petroleum Information says that assuming production at all the other 33 wells, primary reserves (only at Patrick Draw) currently proved total 8,580,000 bbl.

West Desert Springs has eight oil wells completed. There are five active wells there now. Operators include Union Pacific, Texas National, Pubco Petroleum. Gages here are smaller than at Patrick Draw, but success has been good.

The next chapter. Of the half-dozen most active areas in the nation today, the Patrick Draw-Desert Springs portion of the Rockies is one of the most promising. Here is an area that apparently can't miss in success. Drilling in the coming weeks should see a solid green area build up from the southernmost anchor at Patrick Draw northward onto the Arch Unit. The high potentials in this field make it the most attractive area in Wyoming today. Only two Rocky Mountain oil arenas are rivals for 1960 drilling honors—Northwest Lisbon and northeastern Powder River. In any event, all three will make drilling history for the Rockies this year. Locations and completions are popping up faster than pins can go on the maps.

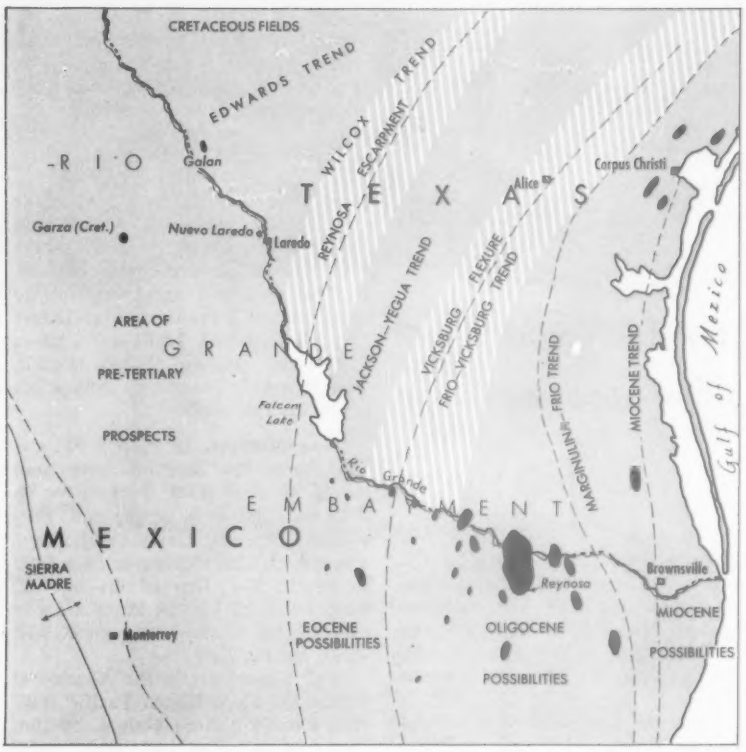
A large gas flow was reported at a Playa Unit well, Pubco 4-21-G Playa Unit, 21-20n-98w. The well flowed 55 M.M.c.f.d. through 2-in. tubing from Almond perforations at 5,718-54 ft. This well is 1 mile west of the southernmost producer at Desert Springs. That well, El Paso 7 Unit in 22-20n-98w, flowed 10,600 M.c.f.d. from Almond. There is no drilling between the two wells.

New locations. In Patrick Draw field, three new locations have been staked. El Paso made location for its 20th and 21st wells on the unit. Forest Oil Corp. and Union Pacific have a new Arch Unit location at 19-3 Arch in 19-19n-98w. One of the new El Paso wells, 20 Patrick Draw Unit in 10-18n-99w, is the westernmost well slated for the field.

A drill-stem test in the Almond at Forest Oil Corp.-Union Pacific Railroad Co. 19-2 Arch Unit 3, 19-19n-98w, got oil. The well is the north offset to the 607-bbl. per day producer completed by the same operators in the same section recently. This is the first successful indication of production north of the Arch Unit oil well except for a gas discovery 3 miles to the northeast. There is no drilling in the in-between area.

Colorado Oil & Gas Co. 2-30 Government in 30-19n-98w, a southeast extension to Arch Unit oil production, was abandoned. This is only the second failure since the Patrick Draw discovery well was completed. The 1-30 Government in 20-19n-98w, south of Arch Unit oil, flowed oil from Almond on tests at 5,027-41 ft. This well is 1½ miles north of the north end of Patrick Draw field. St. Helens Petroleum Co. has three locations in the in-between area.

Wamsutter arch. Union Pacific will drill a wildcat between Table Rock and Patrick Draw at 11-31 UP in 33-19n-98w, less than 2 miles east of Patrick Draw and 2 miles west of an Almond well on the west side of Table Rock Unit in 34-19n-98w. This is one of four new locations announced for the Wamsutter arch area. Trigood Oil Co. has a well at 1 Valdez-Government in 8-18n-98w, 2 miles south of the Union Pacific try. Other new spots include two by Union Pacific in southern West Desert Springs field, and an east extension attempt by Pubco on the north side of West Desert Springs, but inside Playa Unit.



Pemex feels that Texas has drilled at least twice as many wells north of the Rio Grande as were necessary

Pemex plans careful drilling program for Northeast Mexico

A HEARTY WILDCAT program is planned for Mexico's Reynosa or Northeast Zone in 1960. Pemex expects to put down 30 wildcats in northeastern Mexico. Five of these will go to the Miocene zone along the Gulf Coast—a horizon that has yet to be proved productive. Thirteen wells will be drilled to the Oligocene on some of the principal features uncovered by geophysical exploration. Seven will go to the Eocene, and the remaining five will go to pre-Tertiary Cretaceous and Jurassic rocks.

Geological aspects. The exploratory push to Miocene rocks along the Gulf Coast will be closely watched by oil hunters on both sides of the border. There is no production from Miocene on the Mexican side, and very little up the southern coast of Texas as far as Corpus Christi. From there on eastward around the Gulf of Mexico the Miocene is a prolific producer of oil.

The pays in the thick Oligocene section are among the most productive on the Gulf Coast in both countries. This zone stretches from Mexico's Gulf Coast all the way around the shore to Louisiana. It contains some of the biggest fields in oildom. Most Reynosa district output is from the Oligocene section.

In the Eocene, the Jackson-Yegua trend of southern Texas was for many years the sole producer. Jackson production in Texas extends from the Laredo area northeastward to the central coastal region of the state in Austin County. Production in the southwestern part of the trend is old and consistent, but is scattered in its northeastward extension.

The Wilcox trend of Texas extends from the Rio Grande around the coast to southwestern Mississippi. It contains many fields along its path. Exploration in the Wilcox has been a tricky affair. Many good producers have been opened in the midst of dry holes. Current Texas exploration has moved the Wilcox trend to the border of Mexico. Its chances of being a good Mexican producer depend on how much exploring is done on the southern extension across the Rio Grande.

In the pre-Tertiary, Pemex will drill five wildcats to the Cretaceous and Jurassic rocks in the northwestern and western reaches of the Reynosa district or northwestern Rio Grande embayment. These five tests will be some of the most important wildcatting in Mexico in recent years.

Texas' Edwards trend pushed to Galan near the border last year, giving promise of subsequent Mexican success. The shallow Edwards trend extends northeastward along the Balcones fault into Central Texas with some indicated production as far as East Texas. It there becomes undifferentiated as the Washita-Fredericksburg. The intermediate Edwards trend of Texas contains a series of fields in Atascosa and Frio counties. The deep Edwards trend extends from Galan in Webb County at its southwesternmost point northeastward to Karnes County, it's northeastern anchor at this point.

Recent seismic exploration in Reynosa district has uncovered 117 prospects for future drilling.

Some comparisons. Below are some interesting comparisons between Mex-

ico's Reynosa district and an area of comparable size in Southwest Texas, namely District 4.

Pemex predicts that based on the success already attained in District 4, they should find about 2½ billion barrels of oil in the area, together with 24¾ trillion cubic feet of gas. This estimate is based on these comparisons:

	Northeast Mexico	Dist. 4, Texas
Wells drilled 1945-58	393	20,200
Producing wells	273	11,787
Per cent of wells drilled	70	58
Gas reserves as of Jan. 1, 1959 (trillion cu. ft.)	3.2	24.0
Cumulative gas production (trillion cu. ft.)	0.355	10.0
Total gas discovered (trillion cu. ft.)	3.555	34.0
Ratio annual production to reserves	3.0%	3.6%

Since 1897, 22,000 wells have been drilled on the Texas side of the river. Pemex has drilled 451. Pemex feels that from 9,000 to 10,000 wells will be necessary in drilling the prospects on the Reynosa side. This is considerably fewer than Texas, but they feel Texas has drilled at least twice as many wells as were necessary.

One network. Eventually, Pemex plans to unite all gas fields and major consumption areas in Mexico with one pipeline network. This would mean a system extending from Reynosa on the north to Tabasco State on the Isthmus of Yucatan. This will permit Pemex better to adjust supply and demand, and will further provide gas for injection which is planned for the Tampico area.

Present deliveries of gas to Monterrey include the following:

Mexican Gas Co. 14-in. line—30 M.M.c.f.d.
Gas Industriales 14-in. line—70 M.M.c.f.d.
Pemex ..... 22-in. line—40 M.M.c.f.d.

Pemex is drilling on a maximum spacing pattern which varies with the type of production found. To date they have drilled 90 structures, finding 33 of them productive. Of the 30 wildcats on the 1960 program, Pemex has drilled or is drilling on eight locations with 22 yet to go. The drilling of recent years in the Reynosa district has uncovered 100 different producing zones.

Completions. Sixty per cent of the wells at Reynosa are dual completions. There are also several triple completions in the field. One of the triples has three tubing strings. The other has two strings and the annulus.

Production. Present gas output is 350 M.c.f.d. Pemex estimates that reserves run 3.8 trillion cubic feet. Deliverability on gas is estimated at 600 M.c.f.d. Actual production will be increased as additional pipeline capacity is created to Monterrey and other points beyond that city.

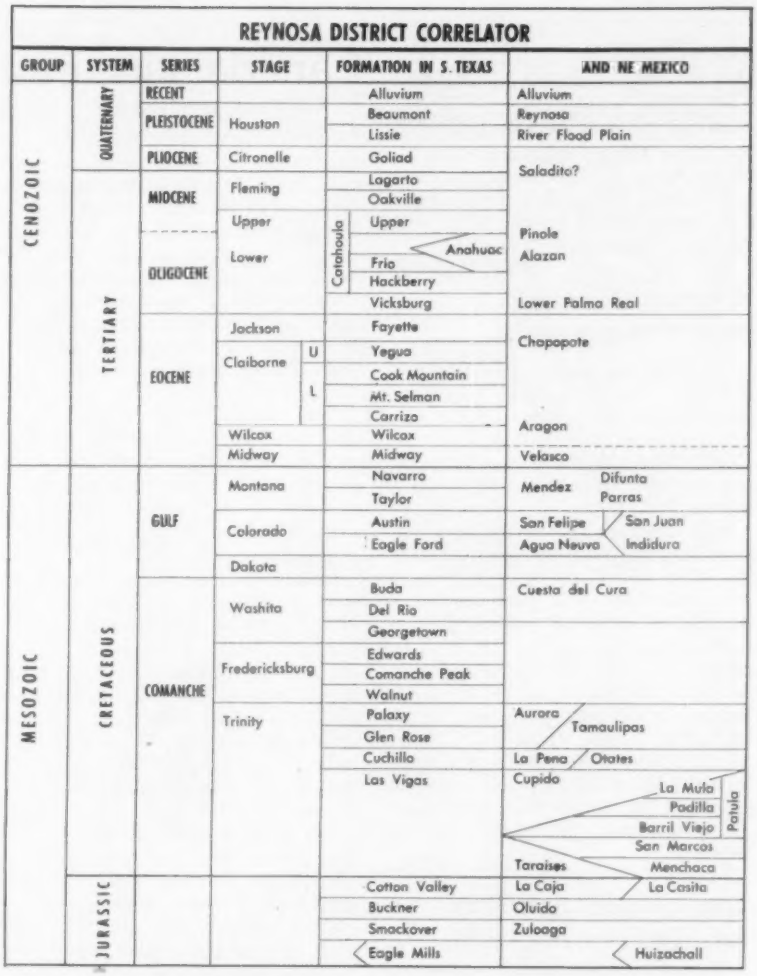
In Reynosa field, there are seven recollection stations which control production at each well here. Gas enters these stations at 1,050 psi. and is moved to the field processing plant. All stations are automatically operated. The system now handles 300 M.c.f.d., and is capable of handling 400 M.c.f.d. There is also a low-pressure gas system serving the Reynosa plant at 800 psi.

Liquid production from Reynosa gas is 6,000 bbl. daily, according to Pemex. Gas leaves the area via four gas pipelines. One crosses the border to the Texas Eastern system. Two 14-in. pipelines operating to Monterrey are privately owned. The fourth line is a 23-in. to Monterrey, owned by Pemex. Pemex gets 14½ cents per M.c.f. from Texas Eastern. The government company intends to fulfill its contract with Texas Eastern, but for the present it does not anticipate exporting any more gas. This may be considered if reserves should grow appreciably.

Active rigs. There are 119 rigs working in the Reynosa district, including three workover rigs. Five more drilling rigs are being moved from the south this summer.

From the standpoint of oil development, Pemex feels that Trevino field offers the greatest potential in northeastern Mexico.

Here's how Pemex wells break down in the Northwest Zone.



THIS FORMATION CORRELATOR strives to point out the Jurassic through Recent rocks in the southern Gulf Coast of Mexico. The chart notes the Texas and Mexican equivalents for rocks of the same age on both sides of the border in the Reynosa district.

Single oil wells	36
Dually-completed oil wells	23
Dual oil/gas wells	18
Single gas wells	124
Dual gas wells	79
Triple gas wells	2

Of the 451 wells drilled since 1945, the above 282 are producers. Also included were 141 dry holes, 12 holes lost because of mechanical difficulty, 11 wells depleted, 5 wells being used for water input.

Arkansas discovery taps more gas pay

An Arkoma basin gas discovery in Pope County, Central Arkansas, flowed more gas on tests. The well is Murphy Corp. 1 S. E. Lee Estate in C NW SE 4-9n-19w, 1½ miles northeast of Scottsville. The well found a fifth pay sand.

Gas was found at 890 ft., but was only a show. First pay was 1,212-29 ft. Flow was 1,280 M.c.f.d. A sand at 1,603-45 ft. was good for 1,216 M.c.f.d. Sand at 1,742-73 ft. showed 6,000 M.c.f.d. Sand at 1,854-60 ft. flowed 572 M.c.f.d. The deepest pay so far is the Hale at 1,937-57 ft. It made 2,255 M.c.f.d. At present depth of 1,964 ft. the Hale made 2,931 M.c.f.d. This new field is 5¾ miles north of Moreland field and 4¼ miles northeast of Dover field. Those two fields have same pay but at a deeper depth.

One oil-pool extension for Illinois in April

No new oil or gas pools were discovered in Illinois in April but an extension to Whittington oil pool in Franklin County was reported.

A total of 137 wells were completed in April, an average of 27 a week. These completions include 48 oil wells, a success ratio of about 35%.

Very good oil wells are being completed in the area about 4 miles southeast of Mt. Auburn in Christian County. In April the J. D. Kuykendall Drilling Co. completed its 1 Ellis in NW SW SW 22-15n-1w. for 470 bbl. of oil a day on pump; and Baughman & Osborn completed its 1 Virginia Matthews "A" in NE SW SW 22-15n-1w for 388 bbl. a day flowing through ⅝-in. choke. Both wells are producing from Silurian limestone.

The deepest well completed in April is Texaco Inc., 3 Minton Community in the center of NE NE 20-4s-7e Hamilton County.

It was temporarily abandoned after reaching a total depth of 5,545 ft. in Dutch Creek sandstone which was topped at a depth of 5,495 ft.

Estimated production for Illinois for April is 6,462,000 bbl. of oil.

Canada stirs, east and west

SASKATCHEWAN'S initial two oil discoveries of 1960 were recently made in the Shaunavon-Instow district of the province, about 45 miles southwest of Swift Current. The two wells, only 3 miles apart, are not likely to spark any major drilling programs since the area in which they are situated has been fairly heavily explored. To Sun Oil Co., the operator of both tests, it could mean a small development program.

Both ventures found oil in the upper Shaunavon zone of the Jurassic formation, the predominant producing horizon in the region with such fields as Instow, Bone Creek, and Leon Lake close by.

Shaunavon. One of the strikes, Sun et al. 6-18 Shaunavon, LSD 6, 18-9-18w3, is only ¾ mile southwest of the presently designated limits of Instow field, but 3¼ miles southwest of the closest previous oil success in the field, Tidewater 1-32 Instow Crown Shaunavon zone producer. In addition, the Delhi-Phillips-Husky-Richfield 13-14 Bone Creek wildcat abandonment that did evaluate the Shaunavon horizon, is 2¼ miles west-northwest.

It found the producing horizon around the 4,475-ft. level and two successive drill-stem tests covered a 76-ft. interval in the zone. The first gave up 100 ft. of mud which was cut 50% with oil and 300 ft. of clean oil. The other gave 170 ft. of slightly oil flecked mud and 40 ft. of slightly oil-cut mud.

While the recoveries do not seem to indicate a strike of significance, other wells in the region have had smaller recoveries but eventually wind up with potentials in the neighborhood of 125 bbl. per day.

The other discovery, lying 3 miles southwest of the 6-18 strike, is Sun et al. 14-35 Shaunavon on LSD 14, 35-8-19w3. That places the venture 1¾ miles north of the field limits of Leon Lake field and 1½ miles northeast of the Tidewater 11-27 Leon Lake Crown wildcat abandonment.

The upper Shaunavon on this hole was found about the 4,425-ft. level and one drill-stem test, over a 33-ft. interval gave up 225 ft. of gassy oil and 120 ft. of oil-cut mud (70% oil).

Both of the discovery holes have reached total depth and have had production casing set on them, the 6-18 test is currently being production-tested while the 14-35 is waiting for service equipment for completion.

Sun drilled both wells on acreage acquired under farmout from Tidewater Oil Co. group that includes such other notables as Atlantic Refining Co., Ohio Oil Co., and Columbian Carbon Co.

In addition to the lands involved in that agreement, Sun Oil on its own recently acquired rights to another 7,840 acres of petroleum and natural-gas rights close to both discovery holes. However, as it was in the form of a Drilling Reservation, half of the area must be returned to the government after a test well has been drilled within the limits of it. Sun paid a total bonus of $41,100 for rights to it, or $5.25 per reservation acre—$10.50 per lease acre.

Far-North permits cancelled

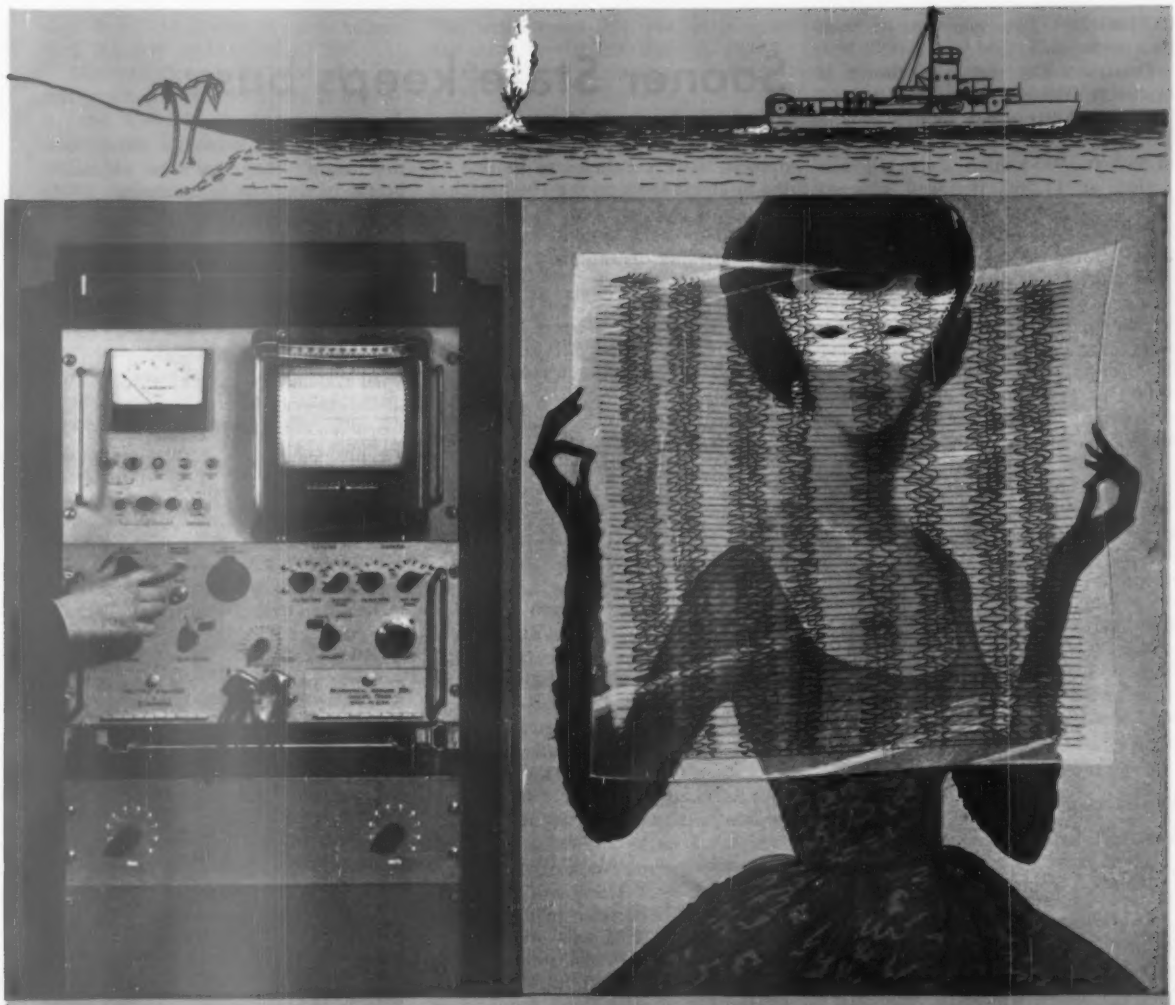
In the Yukon and N. W. Territories 76 permits for exploration of petroleum and natural gas were cancelled during March and April. The surrendered permits covered 3,591,017 acres. They were previously held by seven firms or groups of firms.

The team of Imperial Oil, Ltd., and Triad Oil Co., Ltd., dropped 28 land spreads that added up to 1,589,753 acres, while Amerada and Ohio Oil Co. dropped 11 covering 792,173 acres; Drome Petroleum, Ltd., and an affiliated company dropped 21 parcels covering 846,501 acres; California Standard Co. relinquished three permits totaling 105,879 acres; Shell Oil Co. dropped a single parcel containing 63,360 acres; and Champlain Oil & Refining Co. dropped three tracts covering 112,025 acres.

Rights dropped by Dome Petroleum were the most northerly lands, while Shell's single permit was farther south than any of the other relinquished acreage. Dome's lands were in the McKenzie River Delta area; Shell's lands bordered on the N.W.T.-B.C. boundary. The huge spread dropped by Imperial and Triad was in the general southwest Lac La Martre region in the same region as a number of its recent drilling ventures.

Big pay zone for Alberta's Simonette

The thickest pay section to date for Alberta's Simonette River D3 reef field was found at Shell Oil Co. of Canada, Ltd., 12-1 Simonette on LSD



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12, 1-63-26w5, ½ mile west of Shell 10-1 well.

Devonian D3 reef was found at 11,401 ft. Porosity came in at 11,432 ft. This is a gross pay section of 260 ft. or 230 net pay. Total depth is 11,590 ft. Production casing was landed at 11,560 ft., well plugged back to 11,524 ft. Tubing was run in the hole and production tests are slated soon.

This thick-pay discovery lies on the west side of the field. Shell has 100% interest in the well which was drilled on acreage in which Petrol Oil & Gas, Ltd.-Central Explorers, Ltd., had the option to participate. That team did not participate, however, and retained a 15% net-carried interest.

Simonette River field is being tied into Peace River Oil Pipe Line, Ltd. The field extension line is 36.7 miles long. It is being constructed with 8⅝-in. o.d. pipe. It will have a maximum capacity of 24,000 bbl. daily when in operation this June. The line extends from the Fox Creek station of the Peace River system in Section 36, Township 62, Range 20, West of the Fifth Meridian, to Section 9, Township 63, Range 25, West of the Fifth Meridian.

New gas-distillate find in Gulf

IN OFFSHORE WATERS Kerr-McGee Oil Industries, Inc., and associated companies have completed a gas-distillate discovery on a 2,500-acre lease in the Gulf of Mexico.

The well is located in Block 125 East Cameron, about 35 miles from land in 77 ft. of water. It was drilled to 12,520 ft. and is located on the flank of a piercement salt dome. The well tested gas at the rate of 7 M.c.f.d. through a 16/64-in. tubing choke with flowing pressures of 4,725 lb. After shutting the well, pressure built up to 6,200 lb. It was completed through perforations from 9,732-50 ft.

Kerr-McGee owns 75% of the working interest in the well and owns 12.5% interest in three other 2,500-acre leases on the structure.

Marmaton oil found in Ford County, Kansas

Marmaton Pennsylvanian oil production was tapped at a Ford County wildcat in southwestern Kansas. Discovery well is Tennessee Gas Transmission Co. 1 Barngrover in NE SE SW 26-27s-24w.

The well pumped 247.5 bbl. of oil per day from 4,874-83 ft. Location is 6 miles southeast of Dodge City, 10 miles southeast of Konda field.

Sooner State keeps busy

OKLAHOMA exploration and development work continues to be one of the brightest spots on the 1960 drilling calendar. All sections of the state report important discoveries and followup drilling operations.

Northwest. This section of the state is one of the busiest areas in the nation. Beaver, Woodward, Ellis, Custer, and Dewey counties are all in this picture.

In Beaver County, Petroleum, Inc., 1 Koch, C NW SE 28-1n-28eCM, flowed 729 bbl. of oil per day on tests of the Tonkawa Pennsylvanian at 6,104-26 ft. From Morrow Pennsylvanian it made 1,569 M.c.f.d. with 48 bbl. of oil at 8,141-47 and 8,222-26 ft.

In Ellis County's South Goodwin field, Mobil Oil Co. 1 Ruf, C SE NW 35-20n-26w, became the second well, flowing 13,500 M.c.f.d. from Morrow at 10,996-11,176 ft.

Woodward County's newest discovery is Shell Oil Co. 1 Blasdel in C SW NE 21-23n-22w. It flowed 5,850 M.c.f.d., and 8½ bbl. condensate per million from the Morrow at 8,137-51 ft.

Dewey County's new strike is Carter Division of Humble Oil & Refining Co. 1 Spankler in C SW NE 13-17n-19w. It flowed 48 bbl. of oil per day on 18/64-in. choke from the Tonkawa at 7,829-7,918 ft. North Custer City field's third producer is Mobil 1 Webb in C SE NW 23-15n-16w, Custer County. It flowed 3,900 M.c.f.d. on drill-stem test in the upper Hunton Siluro-Devonian at 14,194-14,337 ft.

Northern. Grant and Garfield counties in northern Oklahoma continue to be hot hunting grounds for oil. In Grant County, Sun Oil Co. 1 Cake, C NW NW 28-25n-4w, flowed 86 bbl. of oil in 6 hours on ¼-in. choke from first Wilcox Ordovician sand at 5,992-6,014 ft. In Garfield County, G-K Industries 1 Hayton in SE NE NE 23-24n-3w, tested 25 bbl. of oil per hour on test of Wilcox at 4,986-99 ft.

Central. Kingfisher, Logan, and Cleveland counties are the focal points of an accelerated drilling campaign in this part of Oklahoma.

Jones and Pellow 1 Corrie in C NW NW 26-19n-6w, Kingfisher County, flowed 254 bbl. of oil per day on ¼-in. choke from Oswego lime at 6,252-60 ft. This is the latest in a string of discoveries throughout this county that has seen so much action in the past few months.

Logan County has a big Hunton gas discovery at an old 5,358-ft. dry hole. It is T. N. Berry & Co. 1 Tibbetts in NE SE NE 35-16n-1e. The well flowed 70 M.M.c.f.d. from Hunton at 4,922-24 ft. after acid treatment.

In Cleveland County, 1 mile west of Northwest Noble field, Pure Oil Co. 1 Valouch in SE NW NW 17-8n-2w, flowed 46 bbl. of oil in 16 hours on 14/64-in. choke from Tulip Creek Ordovician at 8,358-66 ft. It also flowed 1,100 M.c.f.d. and 3 bbl. condensate per hour from ¼-in. choke in Wilcox sand at 8,103-5 ft.

Southern area. Murray and Stephens counties both have important new discoveries.

Continental Oil Co. 1 Springer in SW SW NE 31-1n-2e, Murray County, flowed 165 bbl. of oil per day on 12/64-in. choke from second Bromide Ordovician sand at 6,921-31 ft. In Stephens County, Texaco Inc. 1 Waller, C SW SW 2-1s-6w, flowed 107 bbl. of oil in 7 hours through ¼-in. choke from Dornick Hills at 8,840-69 ft. Shell Oil Co.'s 1 Cash Unit in C SE SW 23-1n-8w flowed 173 bbl. of oil daily on 24/64-in. choke from Missouri Pennsylvanian at 6,841-68 ft.; flowing 4,500 M.c.f.d. and 90 bbl. condensate per day from 7,133-76 ft. in Missouri, and 4 M.M.c.f.d. and 40 bbl. condensate daily from Des Moines Pennsylvanian at 7,256-76 ft. This is one of the best strikes in this area in a long time.

Arkoma basin. The closely watched Orr wildcat in shallow Norris gas field, Latimer County, southeastern Oklahoma, flowed 15,170 M.c.f.d. from Red Oak Atoka Pennsylvanian at 7,193-7,330 ft. It also flowed 17,847 M.c.f.d. from Spiro basal Atoka at 11,514-68 ft. This is one of the most important deep wildcat discoveries in the state. A second deep test near Kinta field, Ambassador Oil Corp. 1 Steele in SW NW NE 5-7n-20e, flowed 5,200 M.c.f.d. from basal Atoka at 5,656-78 ft.

Harper County, Oklahoma field growing rapidly

Northwest Doby Springs field in Harper County, northwestern Oklahoma, gained an important extension

well. It is J. M. Huber Corp. 1 Adams in C NE SW 29-28n-24w.

The well flowed 16 M.M.c.f.d. on test of Chester Mississippian at 6,315-97 and 6,453-75 ft. Later it flowed 11,700 M.c.f.d. through casing. Then 7,870 M.c.f.d. was gaged through 1-in. choke on tubing. The second hour it flowed 8,300 M.c.f.d. through tubing.

Chester is new pay in Kansas Morrow field

Chester Mississippian production was added to Northwest Borchers field in Meade County, Southwest Kansas. Discovery well is Shamrock Oil & Gas Corp. 1 McNaghten, C NW SW 34-32s-28w, 5 miles southwest of Meade.

A calculated open flow of 3,900 M.c.f.d. is reported from perforations in Chester from 5,506-10 ft. This field is a Morrow gas and oil and Marmaton Pennsylvanian gas producer.

Oklahoma Panhandle. Mayflo Oil Co. 1-1 A. R. Turner, SW NE 1-2n-23eCM, south-central Beaver County well, is linking upper Morrow gas production at Northwest Elmwood, and Northeast Elmwood fields.

The well flowed 3 M.M.c.f.d. through 30/64-in. choke from perforations at 7,178-84 ft. Location is 4 miles north of Elmwood, 1 mile northeast of Northwest Elmwood field, 1 mile west of Northeast Elmwood field, and 1 mile southeast of Stekoll 1-35 Laughrin, a shut-in lower Morrow confirmation to 1-26 Ellis, an Upper Morrow discovery.

Prolific producer added to New Mexico's Weir

Weir field in southeastern Lea County, Southeast New Mexico, gained a big oil well at Continental Oil Co. 10 Britt "B-15," 15-20s-37e. The well flowed 756 bbl. of oil per day on potential test through 20/64-in. choke from perforations at 6,430-6,534 ft.

Continental 27 Warren Unit-McKee on the east side of Warren-McKee field, flowed 199 bbl. of oil per day on 16-in. choke from perforations between 8,960 and 9,064 ft. Production is from McKee, called at 8,932 ft.

Michigan play steps up pace

Three rigs are on location and at least six other starts are pending in the new Lee play, 10 miles northwest of Albion oil field. Most of the action is hinged to Perry Fulk 1 Ripley, NW SE NW 26-1s-5w, which tested for 168 bbl. net oil in 19 hours after a 2,000-gal. acid treatment to Black River dolomite section, 4,600 to 4,910 ft.

On the opposite end of the Albion-Scipio play, C. J. Simpson, Dallas, confirmed a recent outpost strike as more than a freak. His second test on the same 40-acre unit in 4-6s-2w, Hillsdale County, logged Trenton dolomate oil sections in both the Trenton and Black River between 3,700 and 4,100 ft. The discovery, 2 miles east and 1 mile south of Scipio pool as now developed, flowed as high as 500 bbl. oil a day natural from 4,100 ft.

More operating companies and contractors are continuing to come into the Albion-Hillsdale areas, many from the Southwest.

C. W. Jetter 1 Carnagel, SW NE SE 30-20n-17w, Mason County, carried good show gas on drill stem in the A-1 Salina beds from 4,017 to 4,117 ft. Rig is being changed from rotary to cable at 4,319 for deepening to 5,500 ft. before the Salina section is tested further.

Land offered. Lands Division of the Michigan Conservation Department will offer over 100,000 acres of state-owned lands for lease at the June 2 auction in Lansing. Much of the acreage is located in northern Michigan including 12,000 acres in Charlevoix and 10,000 more in Montmorency counties.

The state auction is expected to provide a clue to a big lease play the past 90 days in northern Michigan, sweeping from one side of the state to the other, and reportedly grossing over 400,000 acres to a dozen or more different companies. Both Salina and Trenton possibilities are behind the surprise lease play.

Discovery well confirmed in Michigan

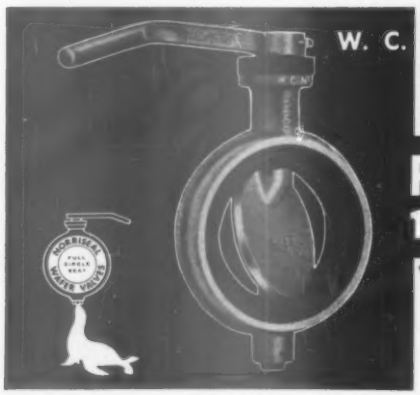
In Michigan Sunray Mid-Continent Oil Co. has finaled a confirmation test to the firm's discovery well, 1 Bollaert, completed in February in St. Clair County.

The 1 Berk-Henderson, NE NE SE 32-6n-13e, flowed 72 bbl. of oil a day through 18/64-in. choke from perforations at 3,800-20 and 3,844-68 ft. opposite the Clinton zone. Tubing pressure was 1,100 lb. and casing pressure registered 1,200 lb. Total depth was 4,310 ft.

The well is located about ¼ mile west of the discovery well, which flowed 200 bbl. of 41°-gravity oil a day through 24/64-in. choke on initial tests.

Both wells were drilled on a 2,500-acre tract held by Sunray. Nearest proven production is 15 miles to the northwest.

The wells are located about 1 mile south of Allenton, Mich., and 40 miles



NORRIS
Field Tested and Approved
150 psi working pressure
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VALVES

Remote gas discovery flows in San Juan

A Dakota gas discovery is reported 5 miles northwest of Farmington in San Juan County, northwest New Mexico. It is Compass Exploration, Inc., 1-35 Federal in NW NW 35-30n-14w. Drilled as a tight hole, the well flowed 7,794 M.c.f.d., absolute open flow. Production is from Dakota Cretaceous perforations at 5,798-5,818 and 5,907-25 ft.

Other news. Two Dakota gas pools were tapped last week in San Juan County. International Oil Corp. 1-3 Martin in SW NW 3-29n-11w was completed for an absolute open flow of 9,806 M.c.f.d. through perforations at 6,457-6,584 ft. The 1-25 Fogelson in SE SE 25-30n-11w, 3 miles northeast of the above well, flowed 3,444 M.c.f.d. from perforations at 6,857-72 ft.

Ohio extension flows

In Ohio, an east extension to Flint Ridge pool in Hopewell Township, Muskingum County, made an initial of 300 bbl. oil per day after fracture. The Clinton sand in the producer, Preston Oil Co. 1 Z. F. Dewitt, Section 2, had 200 bbl. of oil natural with 6 M.c.f.d. of gas at 3,271-3,310 ft.

A second producer confirms the Oriskany gas discovery in Pierpont Township, Ashtabula County. Felmont Oil Corp. reported its 1 O. & L. Clary, Lot 33, the first offset to 1 Myron Hudson, Lot 22, as logging the pay at 2,357-61 ft. The well had a natural gage of 3,285 M.c.f.d. with a rock pressure of 910 psi.

In Swan Township, Vinton County, Ridgedale Oil & Gas Co. moved about ⅓ mile east of the Clinton production and completed 4 Ira H. Shurtz, Section 14, as a 6,580-M.c.f.d. gasser while still in the pay from 2,773-92 ft. Initial rock pressure was reported as 800 psi.

Oklahoma's Kingfisher area continues strong

A dual-zone discovery was completed 1 mile east of East Hennessey field in Kingfisher County, West Central Oklahoma. Discovery well is Jones and Pellow Oil Co. 1 Gabriel in C SW NE 14-19n-6w.

From Manning Mississippian the well flowed 150 bbl. of new oil in 10 hours through 24/64-in. choke from perforations at 6,466-74 and 6,493-6,503 ft. From Meramec Mississippian through open hole at 6,685-6,725 ft. the well made 108 bbl. per day on ¼-in. choke.

Another well, the 1-C Schimanek in C SW NE 16-19n-6w, flowed 160 bbl. of oil in 24 hours through 20/64-in. choke on natural test of the Meramec in open hole at 6,828-47 ft. The 1 Ricks-B in C SW SE 16 flowed 294 bbl. of oil in 6 hours through 30/64-in. choke from Meramec in open hole at 6,869-80 ft. Manning perforations at this same well at 6,638-68 ft. got 108 bbl. in 12 hours, natural, through ¼-in. choke.

Significant Niobrara find for Wyoming

AN IMPORTANT Niobrara Upper Cretaceous oil discovery is reported in Converse County, Powder River basin, northeastern Wyoming.

The discovery well is Samedan Corp. 1 Government in NE NW 26-34n-73w. The well flowed at the hourly rate of 11 bbl. through ¾-in. choke for 18 hours from perforations at 11,886-11,910 ft. Total depth is 12,658 ft. Samedan started deepening this well last winter. It was an old 1950 operation of L. H. Pearson. Total depth then was 11,202 ft. Samedan hasn't released tops, but at the old well the Mesaverde was 8,800 ft., Steele 9,477 ft., Shannon 10,732 ft., and base of Shannon at 10,915 ft.

There is very little Niobrara production in the Powder River basin. There is some shale production at Salt Creek and Teapot fields, also at Smokey Gap. Closest field to the new well is Brenning basin, 9 miles south. That 1896 discovery had Tertiary White River oil. Muddy and Dakota Cretaceous production lie about 12 miles west at Glenrock field.

Three fields named. Official nomenclature was given to three new fields in Wyoming. Rainbow Ranch was discovered at True Oil Co. 1 Wolff-D, NE SE 35-49n-71w, Campbell County, a Minnelusa Pennsylvanian discovery. Cellers Ranch was opened at Texaco Inc. 1 State in SW SW 13-44n-82w, Johnson County. This Pennsylvanian Tensleep well is 1 mile northwest of North Fork field. Cole Spring Draw was opened at Sinclair Oil & Gas Co. 1 Grizzly Cattle Co. in SE NE 19-23n-88w, Carbon County. Flow was 8,150 M.c.f.d. from Sundance Jurassic.

New gas-condensate pool for Texas

IN TEXAS, Gulf Oil Corp. announced a multiple new pool gas-condensate discovery in Red Deer Creek field, Roberts County.

The new discovery well, Gulf's 2 Osborne in Section 26, Block B-1, H&GN Survey, is dually completed from perforated intervals of granite wash at 9,570-90 ft. and Basal Pennsylvania conglomerate at 10,840-90 ft. In initial production tests of the lower zone perforations, flow was at the rate of 4.4 M.M.c.f.d. through a 19/64-in. choke. Thirty-two barrels of condensate were recovered per million feet of gas.

The upper zone perforations on initial tests flowed at the rate of 4.3 M.M.c.f.d. through a 22/64-in. choke. Fifty-two barrels of condensate were recovered per million cubic feet of gas.

The well is completed at a total depth of 11,567 ft. in Mississippian lime. Seven-inch casing is set at 10,600 ft. and 5½-in. liner at 10,474-11,535 ft. Two strings of tubing are set on packers to separate the two producing zones. Gulf has approximately 9,000 acres under lease in the area.

South Texas drilling ranges across state

SOUTH TEXAS developments of note extend from Jefferson County in the southeast to Webb County in the far southwestern part of the state.

In Jefferson's Clam Lake field, Shell Oil Co. completed 15 McFaddin-State as a good oil producer in Miocene Ri and "Q" sands. From Ri sand the well flowed 88 bbl. of oil per day from perforations at 5,943-52 ft. Choke was a 7/64-in. From Q sand at 5,876-88 ft. the well flowed 96 bbl. per day on 7/64-in. choke.

Refugio. A new producing area was opened northeast of Bonnie View field in Refugio County, South Texas. Discovery well is Harkins & Co. 1 C. F. Crow. The well flowed 3,700 M.c.f.d. on open flow plus condensate. Gas-liquid ratio was 20,000:1. This is about 50 bbl. per million. The well opens production at the 8,150-ft. zone some 660 ft. southwest of Mission River on the northeast side of the Bonnie View area, 4 miles southeast of Woodsboro.

Webb County. The one-well South Pescadito field, a former rich gas-condensate discovery, is now an oil producer. Ginther, Warren & Co. 1 A. M. Bruni Estate, 4 miles south of Pescadito field in Porcion 28, pumped 60 bbl. of oil per day. Completion was from perforations at 7,035½-46½ and 7,051-57 ft. This well was originally finaled last year. It was then classed as a gas-condensate producer. It made 8,100 M.c.f.d. and 100 bbl. per million.

"Edward Mudwonder Valves keep our Investment down . . . efficiency up"

Lewis Yates, owner of the Yates Drilling Company, Lafayette, La., has proved to himself through his operating records that Edward Mudwonder valves are saving him real dollars. He says:

"Actual accounting records on our Rig #1 prove a point I have always believed to be true. The real savings on a mud valve is the money you don't have to spend to keep it in good operating condition. Checking the cost record for Mudwonder mud valves on our #1 rig showed that these valves have required the bare minimum investment in replacement parts. When such is the case, we can give top service to our customers without excessive investment in capital equipment and supplies.

"In short, Mudwonder valves help us keep our costs down due to less maintenance and less repair parts and, naturally, less down time."

The confidence Lewis Yates has in Mudwonder valves is found wherever you go in the drilling fields. Mudwonder valves are built to 2", 3" and 4" sizes, with screwed or flanged ends, for 2000 psi WP (4000 psi test), 3000 psi WP (6000 psi test) and in 2" size for 5000 psi WP (10,000 psi test) service. See your favorite oil field supply store, or write Edward Valves, Inc., 1212 W. 145th Street, East Chicago, Indiana. Subsidiary of Rockwell Manufacturing Company.

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another fine product by
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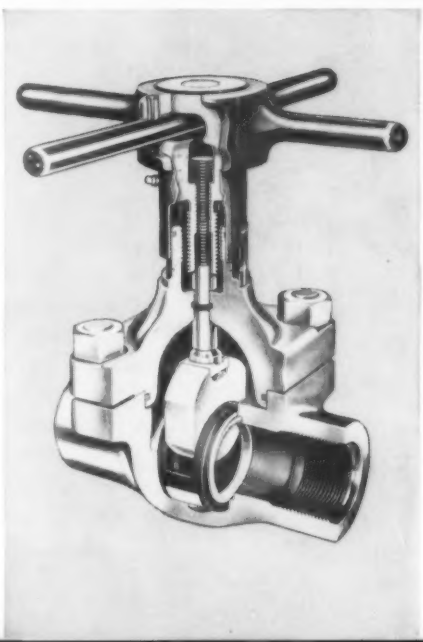
▲ Lewis Yates, owner of the Yates Drilling Company, has found from his own accounting records that Edward Mudwonder valves save him money in maintenance and down time costs.



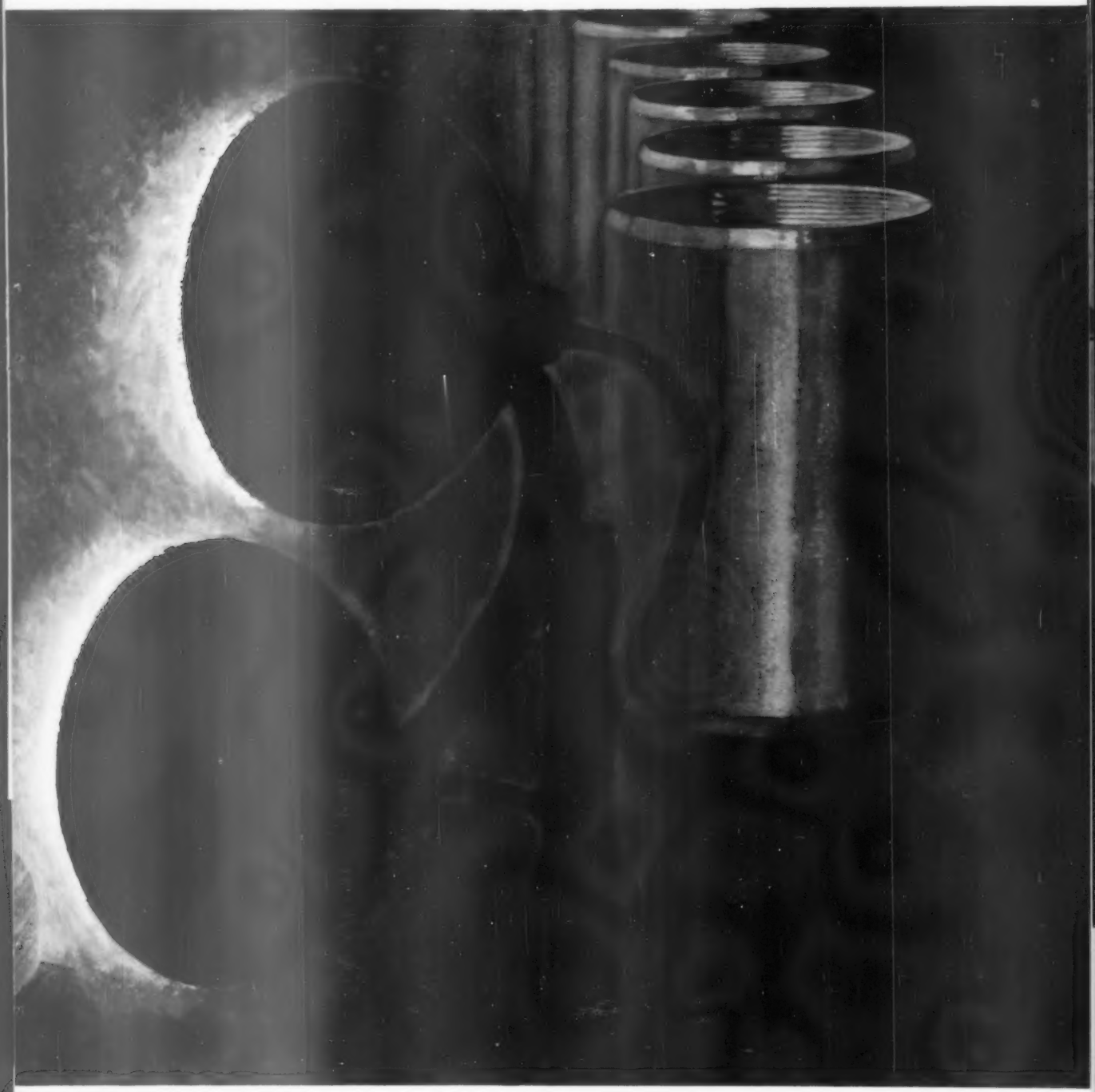
◀ Mudwonder cut-away view shows the one-piece seat insert with Buna-N molded integrally over steel wear rings; chromed gate with "T" slot connection; separated stainless stem and double thread construction.

Look what's getting the 3rd degree

Illuminated by the weird glow of two powerful ultra-violet lamps, this casing coupling is sweating out a check for possible imperfections. It's a process known as Magnaglo inspection. Here a special-clearance coupling is being inspected.

The coupling is magnetized; then drenched with a reddish-brown solution that contains magnetic particles coated with fluorescent dye. If there is a surface defect on the coupling, fluorescent particles cling to it—held by the magnetic field which builds up around any imperfection in the steel.

The inspector then slowly rotates the coupling on a potter's wheel. He scans it carefully for any tell-tale



gleam that clearly indicates an imperfection.

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The April completion account

	TOTAL COMPLETIONS							WILDCAT WELLS								
	Total	Crude	Cond.	Gas	Dry	Service	Footage	Total	Crude	Cond.	Gas	Dry	Footage	C.T.	D.D.	Act. op.
Alabama	2	2	0	0	0	0	23,016	0	0	0	0	0	0	0	0	4
Arkansas	59	26	1	3	25	4	226,040	14	1	1	0	12	63,843	0	0	76
California	93	50	0	8	34	1	471,612	21	0	0	1	20	105,101	2	0	98
Colorado	44	15	1	2	26	0	204,916	22	4	0	1	17	110,445	0	1	90
Florida	1	0	0	0	1	0	15,294	1	0	0	0	1	15,294	0	0	3
Illinois	71	33	0	0	37	1	151,007	13	0	0	0	13	22,277	18	2	316
Indiana	70	23	0	1	44	2	97,580	24	3	0	0	21	31,159	14	1	115
Kansas	183	62	0	5	115	1	655,735	71	6	0	0	65	247,256	15	0	322
Kentucky	67	22	0	7	38	0	100,224	8	2	0	0	6	13,112	47	1	105
Louisiana	228	88	26	13	101	0	1,980,576	40	3	0	1	36	375,754	0	0	399
North	70	22	0	11	37	0	297,439	17	2	0	1	14	94,139	0	0	146
South	120	48	19	2	51	0	1,256,920	20	1	0	0	19	241,306	0	0	197
Offshore	38	18	7	0	13	0	426,217	3	0	0	0	3	40,309	0	0	56
Michigan	52	15	0	0	24	13	144,489	18	0	0	0	18	61,245	38	0	158
Mississippi	58	41	1	1	15	0	586,293	15	5	0	1	9	136,888	0	0	49
Missouri	1	0	0	0	1	0	3,390	1	0	0	0	1	3,390	1	0	1
Montana	14	7	0	1	6	0	67,657	5	1	0	0	4	22,701	12	0	34
Nebraska	63	14	0	1	48	0	362,101	23	0	0	0	23	125,767	0	0	56
New Mexico	128	76	7	21	23	1	631,974	21	4	1	1	15	115,015	35	2	170
West	48	15	5	20	7	1	215,543	6	1	0	0	5	32,354	14	1	48
East	80	61	2	1	16	0	416,431	15	3	1	1	10	82,661	21	1	122
New York	25	13	0	2	3	7	37,910	2	0	0	1	1	5,902	24	0	17
North Dakota	19	10	0	0	9	0	129,562	5	0	0	0	5	22,079	0	1	34
Ohio	71	24	0	19	27	1	169,889	2	0	0	1	1	6,992	67	0	191
Oklahoma	286	130	3	32	116	5	1,272,885	46	7	0	6	33	245,932	95	18	645
Pennsylvania	118	39	0	43	13	23	356,020	2	0	0	0	2	11,666	107	7	61
South Dakota	3	1	0	0	2	0	20,664	1	0	0	0	1	3,610	1	0	4
Tennessee	12	0	0	0	12	0	9,222	12	0	0	0	12	9,222	12	0	25
Texas	1,231	662	60	45	430	34	5,291,025	242	12	8	10	212	1,106,136	60	32	1,017
District 1	97	55	0	2	40	0	270,543	31	1	0	0	30	104,818	0	1	29
District 2	55	18	10	4	22	1	385,816	12	1	2	0	9	92,431	0	1	60
District 3	99	30	13	6	50	0	723,321	18	0	2	0	16	153,371	0	2	98
District 4	74	18	15	5	36	0	448,023	15	0	1	0	14	108,603	5	5	76
East (5 & 6)	88	48	2	0	38	0	307,445	20	0	2	0	18	105,105	0	0	74
District 7-B	193	93	3	15	79	3	524,528	57	4	0	8	45	142,196	0	5	76
West (7-C & 8)	346	247	6	3	78	12	1,756,718	55	4	1	2	48	246,896	17	7	381
District 9	211	121	1	2	69	18	526,674	31	2	0	0	29	122,601	38	11	117
District 10	68	32	10	8	18	0	347,957	3	0	0	0	3	30,115	0	0	106
Utah	28	17	0	0	11	0	163,408	10	1	0	0	9	62,099	0	0	36
West Virginia	48	1	0	34	8	5	121,071	1	0	0	0	1	6,600	44	0	187
Wyoming	68	32	0	2	34	0	375,407	28	2	0	1	25	165,203	4	0	144
Total April 1960	**3,043**	**1,403**	**99**	**240**	**1,203**	**98**	**13,668,967**	**648**	**51**	**10**	**24**	**563**	**3,094,688**	**596**	**65**	**4,357**
Total Mar. 1960	3,506	1,677	118	263	1,372	76	15,964,823	764	63	7	18	676	3,537,801	534	40	4,223
Cumulative 1960	**13,834**	**6,444**	**449**	**1,143**	**5,376**	**422**	**60,772,233**	**3,029**	**266**	**32**	**94**	**2,637**	**13,978,517**	**2,425**	**170**	....
Cumulative 1959	16,016	8,058	426	1,166	5,950	416	67,482,666	3,074	313	44	104	2,613	15,257,297	....	....	....

Note: C.T. = Cable-tool comp. D.D. = Drilled deeper. Act. op. = Active operations.

. . . and in Canada

	TOTAL WELLS							WILDCATS					
	Total	Oil	Gas	Dry	Service	Footage	Cum. 1960	Total	Oil	Gas	Dry	Footage	Cum. 1960
Alberta	86	48	15	23	0	628,930	565	21	6	3	12	167,223	161
Saskatchewan	17	13	0	4	0	65,041	143	1	0	0	1	3,495	32
Manitoba	0	0	0	0	0	0	20	0	0	0	0	0	5
British Columbia	3	0	0	3	0	14,991	73	3	0	0	3	14,991	41
N. W. T.	4	0	0	4	0	13,006	12	4	0	0	4	13,006	12
Western Canada	**110**	**61**	**15**	**34**	**0**	**721,968**	**813**	**29**	**6**	**3**	**20**	**198,715**	**251**
Ontario	29	6	10	12	1	55,685	94	...	...	...	...	.....	....

Prospects good for Cass County, Texas

IMPORTANT Cotton Valley Jurassic exploration in Cass County, East Texas, is uncovering a significant discovery prospect. It is Happy Gist at the El Grant Unit well on Lavinia Moren Survey, A-681, proposed Smackover Jurassic wildcat 2½ miles southwest of Bivins.

A drill-stem test at 10,345 ft. is being run after finding good gas shows on mud log at 10,328-35 ft. This is the third such showing at the wildcat. A test at 10,208-29 ft. got 2,000 ft. of water cushion and 2 gal. clean oil. A test at 9,735-54 ft. got 1,800 ft. water cushion, showed gas in 30 minutes after tool was closed. Recovery was 1,800 ft. of gas and oil-cut water cushion and 90 ft. of mud and gas-cut oil, 60% oil.

This new Jurassic indicator is 2¾ miles northeast of East Linden Cotton

April footage tally

	FIELD WELLS					WILDCAT WELLS			
	Oil	Cond.	Gas	Dry	Service	Oil	Cond.	Gas	Dry
Alabama	23,016	.....	.....	.....	.....	.....	.....	.....	.....
Arkansas	89,151	.....	11,075	53,515	8,456	2,648	11,365	.....	49,830
California	256,470	.....	43,317	62,281	4,443	.....	.....	1,162	103,939
Colorado	55,266	5,962	2,450	30,793	.....	16,247	.....	2,572	91,626
Florida	.....	.....	.....	.....	.....	.....	.....	.....	15,294
Illinois	76,273	.....	.....	50,452	2,005	.....	.....	.....	22,277
Indiana	33,245	.....	879	28,967	3,330	3,948	.....	.....	27,211
Kansas	196,393	.....	26,020	181,877	4,189	20,808	.....	.....	226,448
Kentucky	28,145	.....	10,322	48,645	.....	3,358	.....	.....	9,754
Louisiana	671,981	330,613	70,945	531,283	.....	21,150	.....	10,537	344,067
North	56,017	.....	45,893	101,390	.....	11,150	.....	10,537	72,452
South	432,557	242,976	25,052	315,029	.....	10,000	.....	.....	231,306
Offshore	183,407	87,637	.....	114,864	.....	.....	.....	.....	40,309
Michigan	54,394	.....	.....	15,958	12,892	.....	.....	.....	61,245
Mississippi	382,174	14,565	.....	52,666	.....	27,326	.....	13,891	95,671
Missouri	.....	.....	.....	.....	.....	.....	.....	.....	3,390
Montana	28,851	.....	2,853	13,252	.....	4,635	.....	.....	18,066
Nebraska	79,606	.....	5,275	151,453	.....	.....	.....	.....	125,767
New Mexico	335,617	48,537	104,004	25,991	2,810	20,845	14,945	12,429	66,796
West	41,521	33,721	104,004	1,133	2,810	6,640	.....	.....	25,714
East	294,096	14,816	.....	24,858	.....	14,205	14,945	12,429	41,082
New York	17,550	.....	2,308	2,150	10,000	.....	.....	3,177	2,725
North Dakota	77,076	.....	.....	30,407	.....	.....	.....	.....	22,079
Ohio	65,230	.....	37,338	57,215	3,114	.....	.....	3,581	3,411
Oklahoma	501,530	22,411	157,458	336,034	9,520	48,834	.....	29,977	167,121
Pennsylvania	66,120	.....	178,259	53,807	46,168	.....	.....	.....	11,666
South Dakota	8,439	.....	.....	8,615	.....	.....	.....	.....	3,610
Tennessee	.....	.....	.....	.....	.....	.....	.....	.....	9,222
Texas	2,540,440	450,926	168,777	947,497	77,249	59,026	74,644	26,738	945,728
Dist. 1	133,615	.....	7,390	24,720	.....	8,621	.....	.....	96,197
Dist. 2	111,051	64,616	26,764	86,037	4,917	6,080	24,011	.....	62,340
Dist. 3	210,386	114,304	28,473	216,787	.....	.....	21,966	.....	131,405
Dist. 4	71,015	117,700	33,523	117,182	.....	.....	8,623	.....	99,980
East	123,648	.....	.....	78,692	.....	.....	14,790	.....	90,315
Dist. 7-B	243,591	11,446	22,488	101,235	3,572	13,618	.....	19,338	109,240
West	1,257,471	56,596	3,277	150,692	41,786	22,588	5,254	7,400	211,654
Dist. 9	264,357	3,722	12,214	96,806	26,974	8,119	.....	.....	114,482
Dist. 10	125,306	82,542	34,648	75,346	.....	.....	.....	.....	30,115
Utah	89,615	.....	.....	11,694	.....	8,016	.....	.....	54,083
West Virginia	1,685	.....	87,085	15,798	9,903	.....	.....	.....	6,600
Wyoming	170,620	.....	7,915	31,669	.....	13,652	.....	5,125	146,426
Total U. S.	**5,848,887**	**873,014**	**916,280**	**2,742,019**	**194,079**	**250,493**	**100,954**	**109,189**	**2,634,052**

	FIELD WELLS			WILDCATS		
	Oil	Gas	Dry	Oil	Gas	Dry
Alberta	324,473	50,653	86,581	49,080	21,678	96,465
Saskatchewan	49,399	.....	12,147	.....	.....	3,495
British Columbia	.....	.....	.....	.....	.....	14,991
N. W. T.	.....	.....	.....	.....	.....	13,006
Western Canada	**373,872**	**50,653**	**98,728**	**49,080**	**21,678**	**127,957**

Valley field production. Sunray Mid-Continent Oil Co. is working at 1 Grogan Minerals Co. on the E. Vickers Survey, A-1062, a new Smackover test 1,614 ft. southwest of the above discovery. It is 3 miles southwest of Bivins and 3½ miles northeast of Kildare.

New wildcat. A deep wildcat is slated for the Hainsville salt dome in Wood County. Trice Producing Co. et al., will drill to 15,000 ft. to Woodbine at 1 Pool Unit, 2 miles west of Hainsville. Location is on the William Hendricks Survey, A-282. It lies 2 miles north of the Hainsville field discovery. That well was British-American Oil Producing Co. 1 Bessie Weisenhunt. It completed 4 years ago in Woodbine for 259 bbl. of oil per day. That well opened production on the dome. It was recently recompleted in Sub-Clarksville, however, for 6,500 M.c.f.d. plus 150 bbl. condensate per million after Woodbine production declined.

Discovery wells

WESTERN CANADA

Alberta:

CPOG 10-7 Northwest Provost, LSD 10, 7-37-7w4. Viking gas discovery. TD 3-315 ft.

Saskatchewan:

Sun et al. 6-18 Shaunavon, LSD 6, 18-9-18w3. TD 4,583 ft. Shaunavon oil discovery.

TEXAS GULF COAST

Chambers County:

Robert Mosbacher 1 C. J. Robertson, Jr. et al., 1 mile west of Turtle Bayou in Moses A. Carroll Sur., A-8. IP Shut in. Frio gas discovery at 8,585½-87½ ft. TD 8,825 ft. New gas discovery.

Colorado County:

M. T. Halbouty 1 William K. Lehrer et al., 7 miles northwest of Garwood in I&GN Sur. 23, A-281. IPAOF 9 M.M. c.f.d., upper Wilcox 8,947-54 ft. GLR: 25,650:1. 58.2°. TD 11,500 ft. New gas-condensate discovery.

Montgomery County:

Gordon Street Inc.-Bregman & Minchen 1 L. L. Kramer et al., 2 miles southeast of Magnolia on Edward Taylor Sur., A554. IP Shut in gas discovery. Frio 10,352-72 ft. TD 11,291 ft. New gas discovery.

Kenneth Brill . . . plans to keep Conoco active in Rockies.

Former Steno is Now a Veep

. . . in charge of Rocky Mountain operations for Continental Oil Co. It represents quite a change in 30 years.

THIRTY YEARS ago, young Kenneth Webster Brill was working for a paint company in Oklahoma City when he heard about an opening for a stenographer in Continental Oil Co.'s Ponca City office.

He applied for and got the $125-a-month job.

Brill is now a graying 52 and vice president and general manager of Continental's important Rocky Mountain regional headquarters in Denver.

The personable one-time stenographer is in charge of exploration, production, refining, and marketing in Arizona, Colorado, Utah, Wyoming, Montana, North and South Dakota, and northern New Mexico. His marketing activities extend into Idaho and Washington.

He admits that, with the many changes in the oil industry in the last 30 years, there are fewer opportunities today for stenographers to rise to vice presidents. But then, there are fewer male stenographers nowadays.

As a stenographer in the land department back in the early 30's, Brill became interested in leasing and the great opportunity it presented. Realizing he had to have field experience, he became a scout for Conoco in the Ponca City area in the fall of 1932, and moved to the Oklahoma City vicinity in 1934, doing actual leasing for the first time.

He says the secretarial background helped him because it had given him knowledge of the handling of leasing deals.

On January 1, 1937, only 7 years after he had joined the organization, Brill was appointed assistant land superintendent in Ponca City, to handle all land department affairs in Oklahoma.

He first went to Denver late in 1947, as land superintendent for the Rocky Mountain region, an appointment which coincided with the date L. F. McCollum became president of Continental—December 1. The company's Rocky Mountain exploration program became more active, and Brill was appointed regional manager in charge of exploration in 1950.

In 1952, he went to Houston as assistant general manager for the Southern region. He returned to Oklahoma City the next year as general manager of the Central region. From there, he went to New York in 1957 to take charge of reserves and production acquisitions.

It was while Brill was serving in this capacity that Conoco increased its production and refining capacity and marketing outlets by acquiring Buffalo Oil Co.; Kewanee oil properties in New Mexico; Western Oil & Fuel Co.; and International Refining Co. of Minneapolis.

Brill was elected vice president in 1958, and returned to Denver early this year as assistant regional manager. On May 1, he was promoted to succeed the retiring J. W. Liddell as general manager of the Rocky Mountain region. He says he plans to follow the policy of keeping Conoco one of the most active companies in all branches of the oil business in the Rockies.

Brill was born in Romney, W. Va., but his family moved to Kaw City, Okla., when he was an infant, and he spent his early years there. His formal education was obtained at Hill's Business College in Oklahoma City, from which he graduated in 1926.

●

Lee A. Adams, Jr., supervisor of oil property purchases, will direct the new Dallas office of Kern County Land Co. Adams was in charge of reservoir engineering in Pan American Petroleum Corp.'s Fort Worth office before joining Kern County Land.

C. E. Davis, resident manager of Ford Motor Co.'s Long Beach, Calif., oil operations, has retired. He will continue to represent Ford's oil interests on a retainer basis.

Fred R. Heller, project engineer with Bay Petroleum Corp. in Chalmette, La., has joined C. F. Braun & Co. in Alhambra, Calif., as design engineer.

M. J. van Loben Sels, consulting engineer and a director of Buttes Gas & Oil Co., has been elected president of Buttes. He succeeds **O. G. Green,** who has retired. **Morton H. Gleason,** a director of Buttes, has been elected vice president of the company. **Jeff Watts,** assistant general manager, has been promoted to general manager and chief engineer.

HONORED for a long and valuable service to South Penn Oil Co. was Charles L. Suhr, left, chairman, at the recent South Penn annual meeting. George J. Hanks, right, chairman of the executive committee, and John Selden, center, president, presented a silver tray to Suhr in recognition of his 68 years with the company. Suhr joined South Penn, then Penn Refining Co., in 1892, 6 years after it was established. He was elected a director in 1914, president in 1916, and chairman in 1935. Suhr is also a director of British American Oil Co. and the Pennsylvania Grade Crude Oil Association, an honorary director of the API, and an honorary trustee of National Petroleum Association.

A. Henry Schutte, formerly vice president of Lummus Co., has joined the senior staff, chemical engineering section, of Arthur D. Little, Inc.

Ramsey L. Oakes, New Orleans consulting geologist, has joined Pan American Petroleum Corp. as a senior staff geologist. He will headquarter in Houston.

Richard G. Guerrero, formerly with Shell Oil Co., has joined Cecil V. Hagen, Houston independent, as a geologist.

Bob Kazarian, exploitation engineer for Shell Oil Co. in Salt Lake City, has been transferred to Ventura, Calif., as production foreman.

Meredith Jocelyn has been named manager of Jocelyn-Varn Oil Co.'s new Corpus Christi, Tex., field office.

Robert C. Earlougher, president of Earlougher Engineering, Inc., Tulsa, and **Ben F. Zwick,** manager of the oil and gas department of Chemical Bank-New York Trust Co., New York City, received distinguished achievement medals at Colorado School of Mines' commencement last week. The silver medal is the highest award made to alumni by the school.

R. Bartlett Ewell has been transferred from Shell Oil Co.'s Wilmington, Calif., refinery to the Wood River, Ill., refinery, where he will be special technologist.

John A. Cover has been named technical manager of the Port Neches, Tex., plant of Goodrich-Gulf Chemicals, Inc. He has been at the plant since 1942 as shift foreman, senior technical man, and general technical foreman.

E. L. Moriarty, manager of marketing operations in Manitoba for Imperial Oil Ltd., has been named manager of the prairie marketing region. He will headquarter in Edmonton. **Maurice G. Hurley,** Alberta division sales manager, has been named assistant region manager, sales. **Harvey B. McGonigal,** operations manager in the Toronto marketing department, has been named assistant region manager, administration.

▶▶▶ Personals

Bill R. Weaver, manager of the Kentucky division of Mid-America Minerals, Inc., will open consulting offices in Oklahoma City in July. Weaver was with Tidewater Oil Co. before joining Blackwood & Nichols Co., a forerunner of Mid-America, in 1951. He was Oklahoma division manager of operations for Mid-America before the Kentucky assignment.

Ajax Petroleums, Ltd., Toronto, has changed its name to Canadian Industrial Gas, Ltd. **Arthur M. Starck,** president, has moved up to chairman, a new position. **Maurice F. Strong,** general manager and executive vice president, will succeed Starck as president. **Clarence V. T. Ludlow,** vice president of Empire Trust Co. of New York, has been elected a director.

Harold W. Owens, district geologist for Humble Oil & Refining Co. in Tallahassee, Fla., has been named winner of the 1960 George C. Matson award of American Association of Petroleum Geologists. The award goes to author of the best technical paper presented at the AAPG annual meeting. Owens will formally receive the award at next year's annual meeting in Denver.

K. H. Hiller has been appointed a senior research chemist in the well logging and basic producing research section of California Research Corp.'s La Habra, Calif., laboratory. **P. E. Baker** has been named senior research physicist, oil recovery processes, and **C. H. G. Oldham** and **S. H. Yungul** have been named senior research geophysicists, geophysics research section. At the Richmond, Calif., laboratory of Cal Research, **R. H. Kozlowski** has been named senior research chemist, petroleum process development, and **D. R. Wilgus** has been appointed senior research chemist in petroleum products research.

Dr. R. Clarke Morris, research supervisor in Shell Development Co.'s Emeryville, Calif., research center, has been given a one-year assignment in England.

Arnold Morway has been named senior research associate, products research, by Esso Research & Engineering Co. **Bernard Dudenbostel, Bob Barnum, John Clarke, Ken Detweiler** have been named research associates. Dudenbostel is in the analytical research division, the others, in products research.

▶▶▶ Personals

Leonard Wilkins has been appointed director of engineering for Texas Butadiene & Chemical Corp. He will be in charge of all project engineering with headquarters in Houston. Wilkins was with Koppers Co., Inc., for 18 years before joining Texas Butadiene. He most recently was project manager on a petrochemical plant in La Plata, Argentina.

Harold C. Teasdel, who will retire June 1 as chairman of The California Co., has been nominated as a director of Mississippi River Fuel Corp. Teasdel has been Calco president since 1947.

William H. Hudson, a director of Three States Natural Gas Co., has been elected president. He succeeds **John A. McGuire,** who has been named chairman, a new position. McGuire had been president since 1952. **Lee Van Atta,** vice president of the company, has been elected a director.

Dr. Henry B. Ferguson, section head in geophysical research for Jersey Production Research Co., has been named senior section head, geophysical research. **Dr. F. H. Deily** has been named research associate in the company's drilling and development division. Deily has been given a temporary assignment with Imperial Oil Ltd.

Bob Bussell, staff production engineer in Pure Oil Co.'s Tulsa office, has joined Skelly Oil Co. as reserves and evaluation engineer in Tulsa. Bussell had been with Pure since 1957.

Wayne E. Glenn, general manager of production for Continental Oil Co., Houston, and 1960 president of AIME's Society of Petroleum Engineers, will be speaker at commencement exercises of Montana School of Mines, Butte, June 6.

James E. Sperling, Albuquerque attorney, has been named 1960-61 president of the Albuquerque Petroleum Club. He succeeds **Curtis J. Little,** consulting geologist. Other new officers are **Tom Corr,** Southern Union Gas Co., vice president; **J. W. Loofbourrow,** Skelly Oil Co., treasurer; and **Ray H. Nordhausen,** Northwest Production Co., secretary.

Emmett Daly, for 35 years president and manager of Papoose Oil Co., Tulsa, has retired. He and associates have sold controlling interest in the company to E. F. Moran, Inc., Tulsa. Daly came to Oklahoma from Pennsylvania in 1907 and has been actively engaged since then in drilling and production. Papoose assets consist primarily of production in Oklahoma, Indiana, and Illinois.

Emil Rod, geologist for Venezuelan Atlantic Refining Co. in Caracas, is being transferred to the parent company's headquarters in the Canary Islands to work on Atlantic's Spanish Sahara concessions. **Franz Keyzer,** geologist for Venezuelan Atlantic, is leaving Caracas to open an office for Atlantic in Libya.

H. D. Spires, Oklahoma City district production superintendent for Tidewater Oil Co., has been named assistant district production manager in the San Joaquin Valley. He will headquarter in Bakersfield, Calif.

John A. Rathbun, assistant Buffalo division sales manager for Texaco Inc., has moved up to division sales manager. He succeeds **J. Knox Pannill,** who has been promoted to assistant general sales manager of Texaco's northern region in New York. **R. G. Murdoch,** assistant division manager in charge of industrial sales for the New York sales division, will succeed Rathbun.

Reese H. Tucker, vice president and a director of Cities Service Oil Co., has been elected a vice president of Cities Service Co., the parent company. He will act as coordinator of exploration and production for the Cities Service system. Tucker has been with the Cities Service companies since 1930. He was chief geophysicist before being named a vice president of Cities Service Oil. He will move from Bartlesville, Okla., to the New York headquarters of the parent company.

Dr. Frank L. Padgitt, manager of vinyl-chloride operations in Ethyl Corp.'s manufacturing department, has joined Tennessee Gas Transmission Co. as director of project development. He will work with company expansion and diversification plans in the field of hydrocarbons utilization and petrochemicals.

Garry Owen, vice president in charge of government relations for Arabian American Oil Co., has been elected a director of Aramco.

R. R. Dean, president of Tennessee Oil Refining Co., a division of Tennessee Gas Transmission Co., has taken on additional duties as president of Hartol Petroleum Corp., a TGT subsidiary. He succeeds **W. Chalmers Burns,** who recently retired. **W. C. Hildebrand,** vice president of Tennessee Oil Refining, will succeed Burns on the Hartol board and has been named a vice president of the company. Also, Dean has been named president and Hildebrand, vice president of Atlantic Coast Terminals, Inc., a Hartol subsidiary.

DEAN

Glenn H. Gaumer, pollution-control engineer with Tidewater Oil Co., has been named refinery representative at Tidewater's Avon refinery, Associated, Calif. He will coordinate work with air and water pollution control at the refinery.

Richard Veghte, field engineer with Trigood Oil Co. in Newcastle, Wyo., has been promoted to district engineer in Casper, Wyo.

R. L. Cathriner, production engineer with Richfield Oil Corp. in Cuyama, Calif., has been transferred to Bakersfield, Calif., as development engineer.

C. C. Dougherty, Jr., engineer at Mobil Oil Co.'s Spivey gasoline plant, Attica, Kans., has joined Black, Sivalls, & Bryson, Inc., as process design engineer in Oklahoma City.

J. V. D. Fear has been promoted to section chief, process development, in Sun Oil Co.'s research and development department, Marcus Hook, Pa. He was in new products research, Philadelphia research and development department.

Neal Clayton, district geophysicist in Lafayette, La., for Sohio Petroleum Co., has joined Geophysical Exploration Co. of Houston as a supervisor of field operations.

Kenneth Jicha, engineer in the mechanical design division at the Bayway refinery of Humble Oil & Refining Co.'s Esso Standard Division, Linden, N. J., has been promoted to senior engineer.

Personals

Norman L. Tomberlin, mechanical engineer with Shell Oil Co., has been transferred to Abilene, Tex., from Wichita Falls, Tex.

D. Carlton Jones has been named a vice president of Hudson's Bay Oil & Gas Co., Ltd. Jones was promoted to general manager of the production department earlier this month after serving as assistant general manager of production. **S. G. Olson,** superintendent of the Calgary district, has succeeded Jones as assistant general manager, production. **E. J. Chaput,** assistant Calgary district superintendent, has moved up to succeed Olson. **G. J. Maier,** senior staff engineer, has been named assistant Calgary superintendent, succeeding Chaput.

JONES

William F. Roberts, paleontologist for Shell Oil Co., has been transferred to Bakersfield, Calif., from Farmington, N. M.

J. D. Wright, plant foreman for Tidewater Oil Co., has been transferred to Houma, La., from Eagle Lake, Tex.

Dr. F. H. Field has been promoted to research specialist in Humble Oil & Refining Co.'s research and development division, Baytown, Tex.

Bodie C. Pryor, technical manager of the Port Neches, Tex., plant of Goodrich-Gulf Chemicals, Inc., has been appointed manager of polyethylene operations there. Polyethylene facilities are now under construction and will be in operations later this year.

Fred A. Brock, chief research engineer for Geophysical Service Inc., has been named manager of the geophysical products branch, instrumentation product group, for Texas Instruments, Inc., the parent company. He will headquarter in Houston.

James E. Klipp, a division reservoir engineer in Sunray Mid-Continent Oil Co.'s southwest division, Midland, Tex., has been named western Oklahoma district engineer. He succeeds **Ben A. Lovell,** who recently was named division gas coordinator.

J. A. Leask, district production superintendent for Tennessee Gas & Oil Co. in Edmonton, has been transferred to Corpus Christi, Tex., in the same capacity. He succeeds **Frank H. Harrell,** who has resigned. The Edmonton and Calgary district production offices will be consolidated into one office in Calgary July 1. **Vernon T. Bolleter,** Bellaire, Tex., district exploration superintendent for Tennessee Gas & Oil, has been transferred to Durango, Colo., where he will replace **John H. Simons,** now on assignment as district exploration superintendent in Bellaire. **D. C. Anderson,** junior exploitation engineer, has been transferred to Oklahoma City from Casper, Wyo.

Ronald H. Brierley has joined Monsanto Chemical Co.'s Lion Oil Co. division in the research department of the company's Texas City plant. He had been with American Oil Co. in Texas City.

Harold G. Osborn, senior vice president and a director of Continental Oil Co., received an honorary degree from the University of Tulsa at the school's commencement exercises May 29. Osborn was cited for his work in setting up aid to education by indusry.

William F. Brown, manager of manufacturing for Continental Oil Co.'s Rocky Mountain region, has been promoted to special assistant to **Harold G. Osborn,** Conoco senior vice president. Brown will headquarter in Houston.

Glenn Shively, Continental Oil Co., has been elected chairman of the Atchafalaya chapter of American Petroleum Institute. He succeeds **Frank Davis,** Phillips Petroleum Co.

Robert V. Curry, Jr., has been named Middle Atlantic district operations supervisor for Tidewater Oil Co. **Henry J. Gumbley, Jr.,** has been appointed operations supervisor for the New England district. In other appointments, **Robert L. Kelly,** cutting-oil engineer, has been named wholesale sales manager of the New York district. **John J. Duryea** has been named Federalsburg, Md., area sales manager in the Middle Atlantic district. **Robert C. Niles** has been named construction engineer in the New York district office.

Edwin G. Graeber has been named technical director in charge of process engineering for Arthur G. McKee & Co.'s refinery division, Cleveland.

Dr. W. P. McKinnell, Jr., advanced research scientist at Ohio Oil Co.'s Denver research center, has been named supervisor of the center's new analytical department.

John Ricca, general purchasing agent for Arabian American Oil Co. and Aramco Overseas Co., has joined Oasis Oil Co. of Libya, a subsidiary of Ohio Oil Co., as manager of purchasing and traffic. He will headquarter in Tripoli, Libya.

T. B. Hudson, Phillips Petroleum Co., has been reelected president of Fractionation Research, Inc., a cooperative organization maintained by 58 companies in petroleum, chemical, and engineering fields. Other officers are **D. W. Wilson,** Arthur G. McKee & Co., vice president; **E. W. Volkmann,** Koppers Co., Inc., vice president; **W. F. Martin,** Phillips, secretary and treasurer; **Mrs. L. S. Coleman,** Fractionation Research, assistant secretary and assistant treasurer; **R. E. Arnold,** Phillips, assistant secretary; and **T. V. Stevens,** Phillips, assistant treasurer.

Deaths

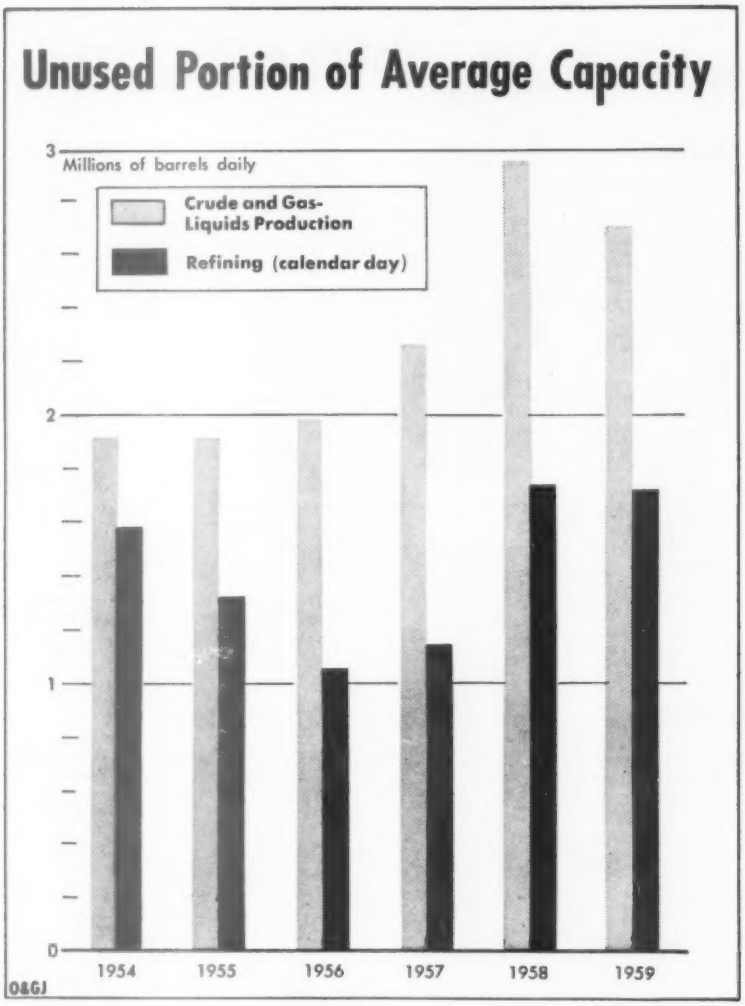
Robert F. Harwick, 48, western regional manager of Du Pont's petroleum chemicals division in Los Angeles and former West Coast editor of The Oil and Gas Journal, died May 19 in Cleveland after a heart attack. Harwick was attending the mid-year meeting of API's Division of Marketing in Cleveland. He was with the Journal before joining Du Pont in 1950. He also had been with Gulf Oil Corp. and C. F. Braun Co.

Oliver Jenkins, pioneer Kentucky independent operator, died May 16 at his home in Paintsville, Ky.

Wilmer Dallam Masterson, Jr., 51, professor of law at Southern Methodist University and editor of Oil and Gas Reporter, publication of the Southwestern Legal Foundation, died May 20 at his home in Dallas. Masterson was with Shell Oil Co. at one time.

J. L. Kennard, president of Kennard Oil Co., Evansville, Ind., died May 14 at his home in Evansville after a heart attack.

Edmond O. Markham, 67, Tulsa independent geologist, died May 21 in a Tulsa hospital. Markham was with Carter Oil Co. before becoming an independent in 1951. He was a past secretary-treasurer of American Association of Petroleum Geologists.



DESPITE THE FACT that they have less surplus capacity than producers . . .

Refiners are chief victims of high inventories, price erosion

BY JOHN C. CASPER

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,866,310	UP	66,750	DOWN	395,840
Crude stocks	259,828,000	DOWN	697,000	UP	740,000
Completions	841	DOWN	93	DOWN	199
Refinery runs	7,935,000	DOWN	99,000	UP	44,000
Gasoline stocks	214,128,000	DOWN	1,931,000	UP	10,518,000
Kerosine stocks	22,922,000	UP	975,000	DOWN	290,000
Distillate stocks	87,972,000	UP	2,039,000	DOWN	6,116,000
Residual stocks	38,875,000	UP	612,000	DOWN	15,609,000
Four-product stocks	363,897,000	UP	1,695,000	DOWN	11,497,000
Total imports	1,722,600	UP	76,200	UP	359,500

OVER THE PAST 6 years, excess refining capacity has been much less than excess producing capacity. The unused refining capacity has averaged only about two-thirds of unused producing capacity.

Last year was a near-typical year. Surplus refining capacity averaged 1.71 million barrels daily. Surplus producing capacity was 2.7 million barrels daily.

And yet, refiners have had more trouble from high product inventories and low prices than crude producers. Part of the refiner's problem stems from the fact each operator knows that he can cut processing cost on a barrel of crude if he can run more barrels and market the products.

In years of rapidly increasing product stocks, any refiner will tell you that total runs are too high. It is an industry problem. But when prices are cut because of pressure from excessive inventories the other refiner is to blame for the disaster.

The short refinery bar for 1956 on the chart is short because runs were high that year, not because capacity was low. Crude runs averaged 7,937,000 bbl. daily for the year and even the Suez crisis didn't use up the product surplus. Product stocks increased 65 million barrels during the year.

Also, tall bars for 1958 and 1959 were not due to abnormal gains in refining capacity. The apparent surplus was due to restraint in use of refining capacity, restraint that was forced by high inventories and low prices.

Proration Affects Production Surplus

The effect of a big surplus producing capacity is limited by proration in some of the important oil states.

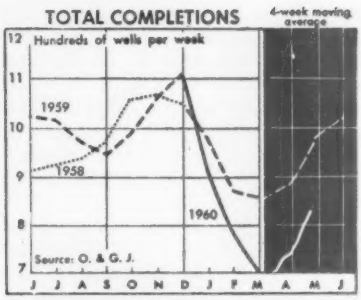
Note that tallest production bar was for the year 1958. Again, capacity to produce crude and gas liquids did not take a big jump that year. In fact average producing capacity for the year showed a gain of only about 150,000 bbl. daily.

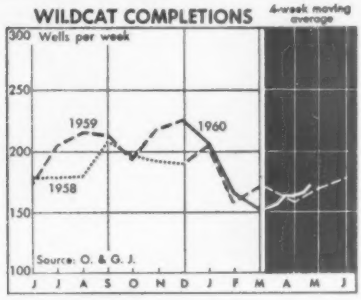
The unused portion of producing capacity increased sharply because crude production was cut back. It had to be cut back. Inventories at the start of the year were at an all-time high and the outlook for demand was gloomy because of the expected drop in exports with the reopening of Suez Canal.

Bars on the chart are based on average capacity for each year compared with actual operations. Production includes both crude and natural-gas liquids.

Refining capacity is on a calendar-day basis. Capacity for a year is the average of opening and closing capacities as reported by The Oil and Gas Journal.

DRILLING





Active Rotary Rigs

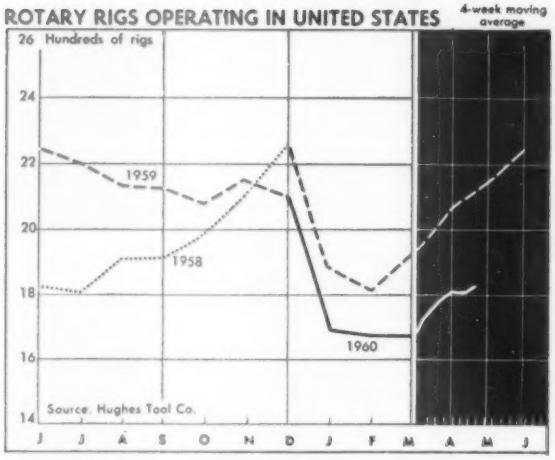
	5-23-60	5-16-60	5-25-59
Alabama	5	5	7
Alaska	5	5	(†)
Arkansas	11	11	17
Arizona	2	1	2
California	100	98	97
Land	94	93	93
Offshore	6	5	4
Colorado	28	25	49
Florida	1	1	3
Land	1	1	2
Offshore	0	0	1
Illinois	52	47	32
Indiana	8	6	6
Iowa	0	0	3
Kansas	138	122	144
Kentucky	5	5	7
Louisiana	288	281	353
North	41	40	32
S. Inland waters	113	116	140
S. Land	80	75	130
Offshore	54	50	51
Maryland	0	0	0
Michigan	42	38	24
Mississippi	64	55	68
Missouri	3	2	1
Montana	20	20	19
Nebraska	24	28	20
Nevada	0	0	0
New Mexico	119	113	123
New York	1	1	1
North Dakota	20	15	41
Ohio	5	4	2
Oklahoma	193	171	259
Oregon	1	1	0
Pennsylvania	10	11	11
South Dakota	1	0	3
Texas	655	655	794
S. Inland waters	7	8	2
S. Land	177	177	192
Offshore	1	2	0
North	44	41	160
Panhandle	52	53	(*)
East	62	62	(*)
West Central	199	204	277
West	113	108	163
Utah	31	26	27
Washington	0	0	0
West Virginia	4	3	7
Wyoming	59	62	77
Total U. S.	1,895	1,812	2,197
Western Canada	129	119	141
Eastern Canada	2	2	0
Grand total	2,026	1,933	2,338

Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. †Data first reported April 4, 1960.

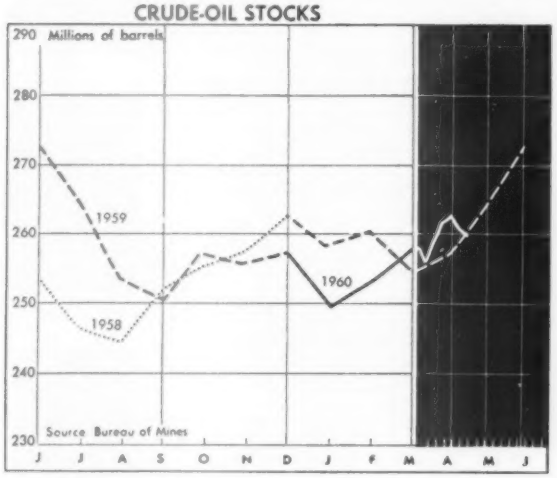
WEEKLY WELL COMPLETIONS . . . WEEK ENDED MAY 21, 1960

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	0	0	0	0	0	0	0	20	39	0	0	0	0	0	1	6
Arizona	0	0	0	0	0	0	0	6	.....	0	0	0	0	0	6	.....
Arkansas	16	8	0	1	7	0	57,617	239	329	3	0	0	1	2	60	56
California	27	19	0	1	7	0	157,112	508	596	5	0	0	0	5	113	135
Colorado	6	2	0	0	4	0	27,384	258	275	2	0	0	0	2	123	163
Illinois	42	16	0	0	19	7	74,430	733	808	12	2	0	0	10	183	138
Indiana	28	7	0	1	20	0	37,695	346	270	11	1	0	1	9	139	90
Kansas	82	35	0	7	37	3	288,920	1,230	1,586	27	7	0	1	19	401	355
Kentucky	15	8	0	0	6	1	22,915	631	632	1	0	0	0	1	75	65
Louisiana	74	42	4	5	23	0	595,605	1,274	1,372	3	0	0	0	3	184	174
North	33	17	0	5	11	0	142,167	404	482	2	0	0	0	2	76	76
South	28	15	3	0	10	0	310,447	656	742	1	0	0	0	1	95	92
Offshore	13	10	1	0	2	0	142,991	214	148	0	0	0	0	0	13	6
Michigan	20	12	0	1	7	0	75,668	282	225	6	3	0	0	3	87	54
Mississippi	4	1	0	0	3	0	32,655	288	247	1	0	0	0	1	91	115
Montana	1	0	0	0	1	0	5,140	92	104	0	0	0	0	0	40	40
Nebraska	11	4	0	0	7	0	63,462	307	305	4	0	0	0	4	119	139
New Mexico	26	14	0	4	8	0	114,118	695	709	6	0	0	0	6	99	79
West	5	1	0	3	1	0	17,965	230	316	1	0	0	0	1	21	25
East	21	13	0	1	7	0	96,153	465	393	5	0	0	0	5	78	54
New York	0	0	0	0	0	0	0	122	122	0	0	0	0	0	7	12
North Dakota	12	5	0	0	7	0	71,889	119	184	6	1	0	0	5	24	40
Ohio	27	8	0	11	8	0	77,689	410	375	2	0	0	0	2	21	9
Oklahoma	91	45	3	8	33	2	394,147	1,481	2,324	24	4	1	3	16	284	349
Pennsylvania	0	0	0	0	0	0	0	246	212	0	0	0	0	0	7	3
South Dakota	0	0	0	0	0	0	0	15	.....	0	0	0	0	0	6	.....
Texas	319	165	18	8	124	4	1,344,396	6,220	7,469	63	4	2	0	57	1,248	1,400
District 1	16	6	0	0	9	1	49,958	437	446	5	0	0	0	5	147	117
District 2	14	4	3	2	5	0	87,104	284	325	4	0	2	0	2	68	89
District 3	21	9	2	0	10	0	145,311	482	443	4	0	0	0	4	90	101
District 4	22	8	3	3	8	0	114,534	452	486	2	0	0	0	2	127	131
East	28	18	1	0	9	0	141,015	471	422	4	0	0	0	4	95	89
District 7-B	45	24	2	1	17	1	109,615	907	1,049	6	1	0	0	5	254	281
West	92	51	1	2	38	0	445,241	1,642	2,334	30	2	0	0	28	275	282
District 9	63	35	3	0	23	2	151,059	1,157	1,413	7	1	0	0	6	165	262
District 10	18	10	3	0	5	0	100,559	388	551	1	0	0	0	1	27	48
Utah	8	5	0	2	1	0	50,623	114	138	2	0	0	1	1	41	38
West Virginia	16	1	0	12	2	1	36,848	298	278	0	0	0	0	0	3	9
Wyoming	16	10	0	1	5	0	70,920	372	310	3	0	0	0	3	153	99
Miscelianeous	0	0	0	0	0	0	0	41	28	0	0	0	0	0	39	21
Total U. S.	841	407	25	62	329	18	3,599,233	16,347	18,937	181	22	3	7	149	3,554	3,589
Prev. week	934	461	23	94	320	36	3,818,328	.....	.....	179	20	2	11	146	.....	.....
Cum. 1960	16,347	7,697	523	1,344	6,314	469	71,786,452	.....	.....	3,554	325	39	116	3,074	.....	.....
Cum. 1959	18,937	9,541	481	1,392	7,020	503	79,596,233	.....	.....	3,589	363	50	113	3,063	.....	.....
Western Canada	26	18	0	2	6	0	149,477	856	910	6	1	0	0	5	259	331

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	5-14-60	5-7-60	5-16-59
Pennsylvania	2,171	2,187	2,438
Other Appalachian	1,632	1,793	1,552
Illinois, Indiana, Michigan	9,774	9,823	8,973
Nebraska and North Dakota	2,850	2,810	2,483
Kansas	10,207	10,070	10,014
Oklahoma	17,607	17,968	16,613
Arkansas	2,089	2,108	1,794
Louisiana	19,694	19,868	19,408
North	3,443	3,168	3,279
South	16,251	16,700	16,129
Mississippi, Alabama, Florida	2,351	2,318	2,245
New Mexico	7,284	7,568	7,968
Texas	110,785	110,021	113,061
East Texas	9,104	8,511	9,037
West Texas	50,720	49,495	54,257
Texas Gulf	20,090	19,790	18,076
Other Texas	30,871	32,225	31,691
Wyoming	18,076	17,802	15,384
Other Rocky Mountain	9,458	9,987	9,292
California	27,755	28,319	32,524
Foreign	†18,095	17,883	15,339
Total	**259,828**	260,525	259,088

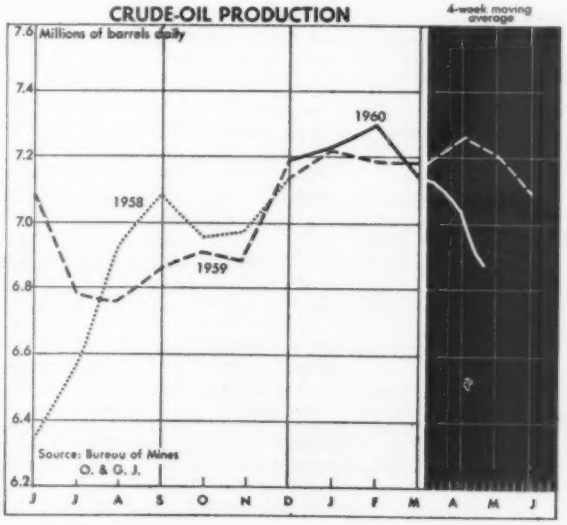
*Bureau of Mines. †Includes 4,592,000 bbl. in California.

DAILY AVERAGE PRODUCTION FOR WEEK

	May 21, 1960 Crude oil	Lease condensate	Total	May 14 total
Alabama	18,850	.....	18,850	19,250
Arkansas	82,600	150	82,750	82,900
California	827,900	.....	827,900	828,700
Colorado	129,700	.....	129,700	128,600
Eastern	40,000	.....	40,000	42,000
Florida	1,000	.....	1,000	1,000
Illinois	210,600	.....	210,600	209,200
Indiana	32,400	.....	32,400	32,800
Kansas	†322,860	.....	†322,860	†302,710
Kentucky	62,300	.....	62,300	64,400
Louisiana	916,500	134,500	1,051,000	1,050,250
North	106,500	6,000	112,500	111,750
South	810,000	128,500	938,500	938,500
Michigan	33,700	.....	33,700	32,900
Mississippi	137,000	3,600	140,600	140,600
Montana	78,000	.....	78,000	79,500
Nebraska	61,000	.....	61,000	60,500
Nevada	100	.....	100	100
New Mexico	293,000	7,000	300,000	300,000
North Dakota	59,200	.....	59,200	57,600
Oklahoma	†538,200	.....	†538,200	†523,400
Texas	2,326,000	89,900	2,415,900	2,415,900
Dist. 1	40,000	3,000	43,000	43,000
Dist. 2	98,000	8,000	106,000	106,000
Dist. 3	306,000	39,000	345,000	345,000
Dist. 4	159,000	18,000	177,000	177,000
Dist. 5	26,000	400	26,400	26,400
Dist. 6	98,000	9,800	107,800	107,800
East Texas field	120,000	.....	120,000	120,000
Dist. 7-B	121,000	175	121,175	121,175
Dist. 7-C	114,000	2,825	116,825	116,825
Dist. 8	944,000	6,000	950,000	950,000
Dist. 9	193,000	1,700	194,700	194,700
Dist. 10	107,000	1,000	108,000	108,000
Utah	120,000	.....	120,000	90,000
Wyoming	339,000	.....	339,000	336,000
Others	‡1,250	.....	‡1,250	‡1,250
Total U. S.	6,631,160	235,150	**6,866,310**	6,799,560
Change from prev. week, up		.....	**66,750**	
Canada	†585,200	.....	†585,200	†549,000
Total U. S. prod., January 1-May 21			1,009,925,000 bbl.	
Same period last year (crude plus cond.)			*1,017,665,700 bbl.	

*Includes 27,175,300 bbl. condensate. †Week ended previous Monday. ‡Alaska and South Dakota.

CRUDE-OIL PRODUCTION



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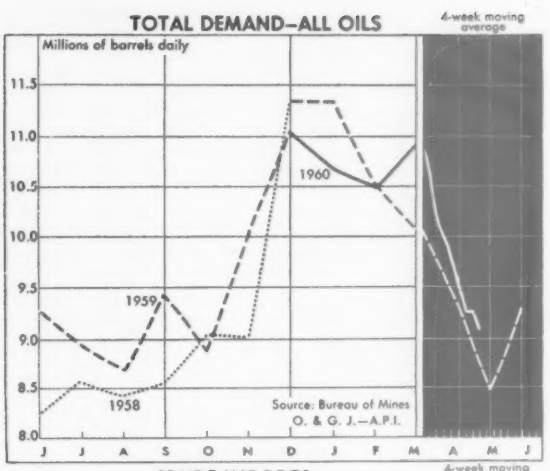

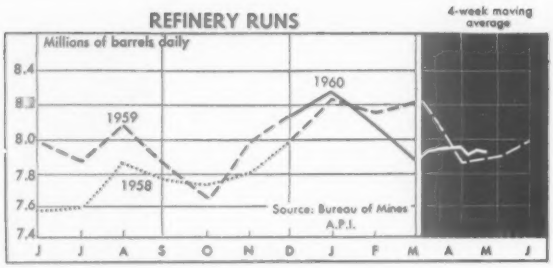

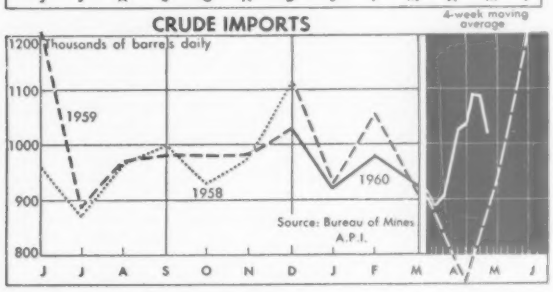

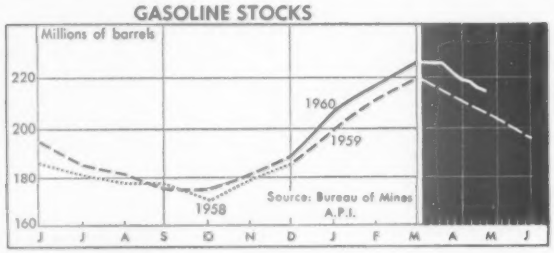

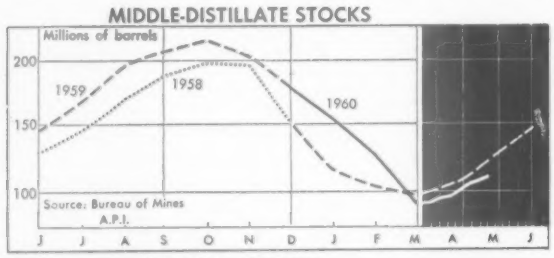

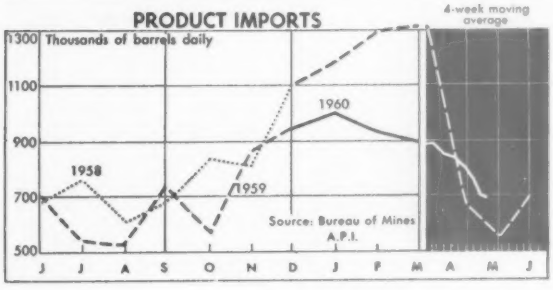

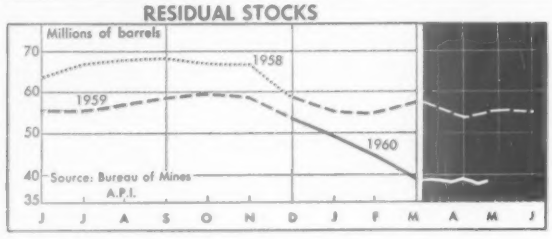

API REFINERY REPORT—MAY 20, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, May 1959 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,161	482.9	46.3	285.7	161.3	46,471	8,527	28,578	10,365	1,014	437.8	19.7	300.4	144.5
Appalachian:														
District 1 ...	101	38.1	3.6	23.6	6.4	6,133	491	2,013	335	89	40.0	3.2	17.4	9.9
District 2 ...	60	40.1	0.9	13.3	5.1	2,974	262	938	338	87	50.2	5.7	15.6	10.5
Ind., Ill., Ky...	1,435	738.9	61.2	294.1	150.7	40,830	4,326	15,025	4,282	1,437	743.8	60.9	272.7	156.8
Minn., Wis., Dak.	126	63.6	4.0	30.4	17.6	6,474	686	3,023	631	103	48.4	4.5	23.7	13.1
Okla., Kans., Mo.	690	376.8	8.3	166.6	22.7	20,205	1,044	7,523	919	713	396.1	8.7	169.4	18.6
Inland Texas ..	291	200.6	10.7	45.0	15.1	7,211	537	1,568	2,414	283	204.1	8.2	49.7	20.3
Tex. Gulf Coast	1,846	955.7	93.0	441.6	139.0	25,767	2,989	9,867	4,189	1,991	994.0	77.6	478.2	167.6
La. Gulf Coast.	688	358.1	37.7	158.9	42.3	12,287	1,538	3,317	1,166	696	367.3	45.2	157.2	48.9
N. La. and Ark.	109	71.6	8.4	19.8	5.9	5,330	477	2,173	126	103	48.3	4.0	23.5	6.7
Rocky Mtn.:														
New Mexico.	24	13.3	0.4	4.4	2.8	938	34	157	86	17	10.8	..	3.4	2.4
Other	251	110.9	4.0	57.7	32.8	6,915	236	2,106	965	244	112.6	2.5	52.9	31.5
West Coast ...	1,153	444.0	38.4	187.0	282.3	32,593	1,775	11,684	13,059	1,119	507.4	4.3	187.5	268.4
May 20, 1960	7,935	3,894.6	316.9	1,728.1	884.0	214,128	22,922	87,972	38,875	7,896	3,960.8	244.5	1,751.6	899.2
May 13, 1960	8,034	3,994.9	356.6	1,680.3	866.4	216,059	21,947	85,933	38,263	.....	.....	.....	.....	.....
May 22, 1959	7,891	3,938.4	212.6	1,730.6	944.9	203,610	23,212	94,088	54,484	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.76	....	....	....	....	....	....	....	....
15-15.9	1.84	....	....	....	....	....	....	....	$1.81
16-16.9	1.92	....	....	....	....	....	....	....	1.86
17-17.9	2.00	....	....	....	....	....	....	....	1.91
18-18.9	2.08	....	....	....	....	....	....	....	1.96
19-19.9	2.16	....	....	....	....	....	....	....	2.01
20-20.9	2.24	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.32	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.39	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:
- Sweet Lake $3.00

Texas:
- East Texas 3.05-3.25
- Conroe 3.23-3.53
- Van 3.08

Pennsylvania Grade:
- Bradford $4.70
- Middle District 4.52
- Southwest Pennsylvania ... 4.25
- West Virginia 4.07
- Buckeye Grade 4.07

Illinois Basin **3.00**

Foreign

Middle East, Persian Gulf (cargoes f.o.b. lifting port):
- Arabian, about 34°, Ras Tanura $1.90
- Iranian, 34.0°-34.9°, Bandar Masur 1.86
- Iranian, 34.0°-34.9°, Abadan 1.81
- Iraq, 36.0°-36.9°, Fao 1.82
- Kuwait, 31.0-31.9°, Mina-al-Ahmadi 1.67
- Qatar, about 41°, Um Said . 2.05

Middle East, E. Mediterranean:
- Arabian, about 35°, Sidon .. 2.29
- Iraq, about 35°, Tripoli, Banias 2.29

Far East (cargoes, f.o.b. Lutong, Sarawak):
- Seria Light, 37° 2.57

Canada:
- Leduc-Woodbend $2.53
- Redwater (Alta.) 2.42
- Smiley (Sask.) 2.18
- Pembina 2.38

Venezuela:
- Cumarebo, 47°-47.9°, Tucupido 3.34
- San Joaquin, 40°-40.9°, Puerto La Cruz 3.08
- Oficina, 35°-35.9°, Puerto La Cruz 2.80
- Tia Juana medium, 26°-26.9°, Amuay* 2.30
- Quiriquire, 16.0°-16.4°, Caripito 2.10
- Lagunillas heavy, flat, Las Piedras* 2.10
- Bachaquero, flat, 15°-16°, Las Piedras* 1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

- ★ Gulf-NY, clean (ATRS — 15.0%) $2.42
- ★ Carib.-NY, dirty (ATRS — 57.5%) 1.17
- ★ PG-Japan, dirty (ATRS — 62.5%) 3.68
- PG-UK, dirty (Scale — 67.5%) (21s. 10d.) ... 3.05

★ Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):
- ★ Regular (91 octane) .. 10.50
- ★ Premium (99 octane) . 13.00-13.25
- Natural gasoline (26-70) 4.5
- Breckenridge 4.0

Gulf Coast (cargoes for coastwise or export movements):
- Regular (90 octane) .. 10.00-10.25
- Regular (92 octane) .. 10.25-10.50
- Premium (98 octane).. 11.00-11.50

California (rack) Los Angeles):
- Regular (88 octane) .. 11.65-12.15
- Premium (94 octane) 12.65-13.15
- Premium (100 octane) 14.00-14.65

Caribbean area (cargoes):
- Regular (87 octane) .. 10.00
- Premium (97 octane) 11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):
- Kerosine 42-44 ..... 9.00-9.50
- Diesel oil (58 d.i. and above) 8.75-9.25
- Distillate No. 1 ..... 8.75-9.25
- Distillate No. 2 ..... 7.75-8.25

Gulf Coast (cargoes):
- Kerosine 41-43 ..... 8.875-9.00
- Distillate No. 2 ..... 7.875-8.00

New York Harbor (barges):
- Kerosine 41-43 ..... 9.8-10.3
- Distillate No. 2 ..... 8.8- 9.3
- Diesel fuel, 48-52 d.i. .. 9.1- 9.6

Caribbean area (cargoes):
- Distillate No. 2 ..... 8.00

Residual Fuel (Bbl.)

Mid-Continent (Group 3):
- Residual fuel (max. 1% S) $1.70-1.80

Gulf Coast (cargoes):
- Bunker C fuel 2.10-2.25

New York Harbor (barges):
- Bunker C fuel $2.47

Caribbean (cargoes):
- Bunker C $2.10

California (rack):
- Bunker C fuel, Los Angeles $2.15

★ Denotes change from previous week.

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FOR SALE EQUIPMENT

8,350 ft. 2⅞" EUE seamless 8R thread, used tubing: 60 cents per ft. 3,000 ft. 2⅞" ditto, 10 thread: 55 cents per ft. Located Elk City, Okla. 1,200 ft. 4" O.D. full hole drill pipe: Located Blackwell, Okla. Carman Supply Co., Phone RIverside 2-3502, 1008 E. 36th St., Tulsa.

FOR SALE: Four (4) 25,000 barrel steel storage tanks 70' dia. x 36' high; and two (2) 35,000 barrel steel storage tanks 78' dia. x 40' high. Used for alcohol storage. Location Louisville, Ky. Complete details upon request. Negotiate with K. M. Miller, Rohm & Haas Company, 222 Washington Square, Philadelphia 5, Pa.

1 BUCYRUS—ERIE 36L Spudder, late model. Rig complete with tools and equipment. Cassel Drilling Co., Inc., Dumas, Texas. Phone WE 5-5019 or WE 5-4369.

FOR SALE

10,000 ft. 14" O.D. Used Lapweld Pipe .281 Wall—41.21 # per ft. Plain end—machine cleaned #1 and Good #2 grade

Single Random Length

Wire, Write, or Phone

COLUMBUS STEEL SUPPLY
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BOILERS, 70,000 #/hr. & 80,000 #/hr. 450 Psi.
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EXCHANGERS, 78 to 2,800 sq. ft.
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VESSELS, 2 ft. to 10 ft. diameter.
FURNACES, 26 MM BTU/hr.
TURBO EXHAUSTERS, 15,360 & 17,000 CFM.
CENT. PUMPS, 15 to 7,000 GPM.
TURBINES, 5 to 290 HP.
TANKS, 1,000 to 29,000 bbl.
COMPRESSORS, (IR) XVG—4 & XVG—2.

BRILL EQUIPMENT COMPANY
DESTREHAN, LA.
TEL. NORCO 6571
35-53 JABEZ ST. NEWARK, N. J.
4101 SAN JACINTO, HOUSTON, TEXAS

FOR SALE EQUIPMENT

DOUBLE DRUM Spudder on IHC truck. Cooper E 563-42-36 complete. New lines. Box 736, Great Bend, Kansas. GLadstone 3-8817.

FOR SALE—One (1) 13⅜" L.R.—No. 51-3 Landis Receding Chaser Pipe threading and cutting off machine complete with standard auxiliary equipment. No. 13⅜" receding No. 50-2 diehead-API taper thread for pipe 8⅛" to 13⅜"—15 HP motor drive. Originally purchased in 1943, total operating time 3½ years, replacement cost is $20,000.00 Complete details upon request. Submit offers to K. M. Miller, Rohm & Haas Company, 222 Washington Square, Philadelphia 5, Pa.

—PIPE—

2,000,000 ft.	2"	3.50# to the ft.
1,000,000 ft.	3"	7.70#
1,000,000 ft.	4"	10.98#
500,000 ft.	6"	19.80#
200,000 ft.	8 5/6"	28#
400,000 ft.	10¾"	35#
75,000 ft.	12¾"	40#
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All No. I Grade plain end and cleaned.

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The following equipment was in first class working order before we broke up the rig.

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PARKERSBURG BRAKE
(Newest model)

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Phone GRant 1-3200

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3-CLARK GAS COMPRESSORS
500 H. P., Model RA-5
14" x 14", 300 RPM With
17" x 14" VTH Cylinders
COMPLETE-EXCELLENT CONDITION
HEAT & POWER CO., INC.
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10' x 145'—	125 PSI 50 trays
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7'0" x 82'—	75 PSI 30 trays
6'0" x 80'—	300 PSI 30 trays
4'0" x 44'—	150 PSI 12 trays
3'6" x 36'—	400 PSI 12 trays
2'6" x 52'—	360 PSI 22 trays
2'2" x 57'—	85 PSI 4 trays

HEAT EXCHANGERS—CONDENSERS

Steel Tube	7,500 to 100 sq. ft.
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RA5 GAS ENGINE 2VTH 17" x 14" CYL

BLOWERS—28,000 CFM @ 17 PSIG
11,880 CFM @ 11 PSIG
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VESSELS PRESSURE—3' to 12' Dia.

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18" AND 20" good used pipe. Very attractive prices. Contact: The Tri-State Pipe Co., Bellaire, Ohio. Telephone OR 8-1453.

FOR SALE: Four Diesel Powered Rotaries complete, Special Built 2,500 ft., 2000 Mayhew, 1500 Failing Special, 1500 Winter Weiss Special, Also, Spudders, 83 Special Tandem, 72 Full Trailer, 71 Truck mounted Speedstars, and #10 Ideco. Star Drilling Supply Co., Chanute, Kansas.

WELL DRILLS—CORE DRILLS. Everything for well and core drilling in both new and used equipment at money saving prices. Fishing tools rented. Send for bulletins. Pressey & Son, Pueblo, Colo.

2—HALL SCOTT "Defender" 2269 V-12 with Marine Reverse Gear Box and Clutch Bore 5¾" stroke 7 Cu. In. Displacement 2181 Compression Ratio 7:00-1 at $1,500. Each. Original cost to government $18,000. These motors are like new. Phone FR 9-5131, Seguin, Texas. Write Texas Acidizers, P. O. Box 47, Seguin, Texas.

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The following used equipment located near Bowie, Texas:

32,000 ft. 5½" O.D.; 15.50 lb.; range 2; J—55; smls. steel casing
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17,000 ft. ¾" sucker rods
12,000 ft. ⅝" sucker rods
1—Ideco type S221 pumping unit w/ZC739 Fairbanks & Morse engine
1—United Supply Co. type 302 pumping unit w/Continental C-96 engine
1—Parkersburg type 64 HGS pumping unit w/ZC739 Fairbanks & Morse engine
1—American T-17 pumping unit
1—BS&B 6' x 20' heater-treator
1—Hanlon-Waters 3' x 12' oil and gas separator
4—210 Bbl. steel welded tanks w/rigging & connections
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P. O. Box 2904, Dallas, Texas
Phone RIverside 2-3786

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Additional information may be obtained by writing:

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BAILEY BRIDGE
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EQUIPMENT WANTED

USED PRI MODEL 111-C portable scintillator crystal dia. 2¼" wt. 8½ lbs. or other similar. P. O. Box 5315, Tulsa, Okla. Tel. RI 2-8271.

PRODUCTION WANTED

WANTED: Producing lease that can be operated on farmout basis, 30 bbls. or more oil. Box L-861, The Oil and Gas Journal, Tulsa, Oklahoma.

COMPLETION RECORDS

MY SET OF Illinois, Indiana, Kentucky completion cards complete from beginning of scout check through January 1st, 1960 on 16 millimeter microfilm, over 95,000 cards. P. O. Box 1531, Denver, Colorado.

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DELAWARE CORPORATIONS formed and serviced. American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

HELP WANTED

TRANSLATORS, Proven ability to translate technical material into fluent English essential. Attractive full time or free-lance arrangement. All languages of interest, particularly Russian. Send resume to: A•T•S, Inc., Drawer 271, East Orange, N.J.

SALES ENGINEER with Station Manager experience. Must be skilled in acidizing, fracturing, cementing and oil field services. Salary comensurate with capacity to produce. Contact Allied Services, Inc., Clark Core, P. O. Box 47, Seguin, Texas. Phone FR 9-5132.

REFINERY INSTRUMENT Engineer with experience on varied type instruments. Give resume of experience, education and salary expected. Box L-843, The Oil and Gas Journal, Tulsa, Oklahoma.

NEW OIL JOB Directory, foreign and domestic, showing where to apply for jobs. 500 selected producing, refining, butane and pipeline companies. Nationwide, $5.00 cash. List Aircraft mechanics' schools—$3.00. OIML Co., Box 2603, Tulsa, Oklahoma.

HELP WANTED

SALES ENGINEER needed, for work with oil and gas industries in Rocky Mountain area with possible Denver location. Experience in control equipment desirable. Some travel required. Excellent growth opportunities. Salary open. Send photograph and complete resume so interview may be arranged. Box L-853, The Oil and Gas Journal, Tulsa, Oklahoma.

OPPORTUNITIES IN RESEARCH

Immediate openings at all levels for qualified personnel in petroleum production research. Experienced personnel or those with advanced degrees in engineering, chemistry, physics, or mathematics will be considered. Problems under investigation include secondary recovery, reservoir analysis, fluid flow, well completions, cements, and mathematical analysis. Please send resume to: Cities Service Research and Development Company, 920 East Third Street, Tulsa, Oklahoma.

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Applicant should have college degree in chemistry or engineering and up to five years experience. Send resume of background to:

Personnel Relations Dept. No. 3
CONTINENTAL OIL COMPANY
Ponca City, Oklahoma

SITUATIONS WANTED

ENGINEER AND PRODUCTION Superintendent: Experienced in all phases of production and qualified as expert in secondary recovery 14-years experience in Mid-Continent. Box L-847, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION SUPERVISOR—12 years experience one company. Production foreman, reservoir tester, plant supervisor, pipeline, corrosion engineer, gas measuring testing, gasoline plant design drafting. ICS Petroleum Engineer. P. O. Box 983, Perryton, Texas.

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MANAGEMENT GRADE engineer or production supervisor, registered professional engineer, presently employed. Minimum salary $15,000. Box L-845, The Oil and Gas Journal, Tulsa, Oklahoma.

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ENGINEER AND PRODUCTION superintendent experienced in all phases of production and qualified as expert in secondary recovery. 14-years' experience in Mid-Continent, Box L-851, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM—Corrosion Engineer, B.S. 1952, experience in cathodic protection and oil field operations. Desire position with growth potential. Will relocate. Age 35, married. Box L-854, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM Engineer—Five years diversified field experience in reservoir and production engineering. Married. Available May 31. Box L-856, The Oil and Gas Journal, Tulsa, Oklahoma.

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HIGHEST PRICE paid for income royalties, overrides, oil properties. A. S. Berry, 109 Midco Bldg., 302 South Cheyenne, Tulsa, Oklahoma.

NOTICE INVESTORS, income producing oil, gas-distillate royalties for sale. Ogden Oil Company. P. O. Box 490, Taylor, Texas.

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IF YOU HAVE substantial development necessary or desirable and present oil and financing conditions make it difficult, have considerable pipe available. Can furnish on deferred secured payment. Must have some equity production to back up for safety, as not interested in speculative development, but can carry on deferred basis, if secure. Box L-857, The Oil and Gas Journal, Tulsa, Oklahoma.

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FINANCIAL Contacts, Underwriters, Private Brokers reached. No shopping. Confidential. Send details to Consultant—817—51st Street, Brooklyn, N. Y.

NOTICE FOR PROPOSAL OF NATURAL GAS FRANCHISE

Proposals for an exclusive natural gas franchise will be accepted in the office of the City Clerk of the City of Wilton Manors, Florida, 524 N. E. 21st Court, Wilton Manors, Fort Lauderdale, Florida, until 8:00 o'clock P. M. on Tuesday, July 12, 1960.

LEASE AND DRILLING BLOCKS

FOR SALE 898 acre lease Apache County, Arizona. $2.00 acre 1%, 12 N, 28 E. Write P. O. Box 997, Scottsdale, Arizona.

SEVEN wells Louisiana: 1,500' Wilcox sand, 113 acres, 20 proven locations. $35,000. C. R. Harwood, 500 Grant Street, Denver, Colorado. Phone Spruce 7-4493.

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Also possible to acquire 1,000,000 barrels semi-proven reserves adjoining.

Lifting costs 50c per barrel. Development costs of $2,500 per acre over 70% intangible. Shallow Bartlesville, Eastern Kansas.

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INTEREST in production 500 acres. 8 oil wells. Drilling additional wells will make a money making deal. Known as the Lyons Leases, Daviess County, Indiana. Box L-846, The Oil and Gas Journal, Tulsa, Oklahoma.

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RE: YUKON OIL BOOM

The charter of Yukon Resources, Limited, whose only present interest is metallic ores, includes exploration and development of oil and gas in the Yukon Territory. Would be interested in assisting a company wishing to participate in the current Yukon oil boom on any basis mutually beneficial. Yukon Resources, Limited, would not be interested in affiliation with individual for speculative promotional purposes. Principals only please. Banking and professional references exchanged.

Yukon Resources, Limited
Box 2165
Whitehorse, Yukon Territory
Canada

LEASE AND DRILLING BLOCKS

5,000 ACRES oil leases, Stewart County, Tennessee; county on Kentucky-Tennessee line. Would assign liberal interest for core drilling obligations. E. I. Wallace, Dover, Tennessee.

MINERAL INTERESTS Webster, Bossier Parishes, La., Liberty, Harris, Cherokee, Delta Counties, Tex., Miller County, Ark. Mason, 103 Ardmore, Shreveport, La.

MONTGOMERY COUNTY, Mississippi on top of the Kilmichael Dome offers 4 likely oil sands at less than 3,500 feet. Surface, magnetomer and seismograph confirms 31-19-7 drill site between Highway 82 and C&G RR. Will block leases at $1.50 an acre on HIGHS. Gusher, 1369 Court, Memphis 4, Tenn.

3,500 ACRES $2 per acre. Lawrence County, Ky. in midst of new gas play. Ten year leases in first year, 1/8 override, no drilling committment, 50 cents per acre annual rental. U. S. Andersen, 8350 Santa Monica Blvd., LA 46.

PROSPECTIVE OIL Land: Suitable townsite acreage in fee, E/35 acres, Sec. 16, Block JKL, PSL Survey, Hudspeth County, Texas, at intersection U. S. Highway 62 and F. M. 1437 Highway, south of Dell City, Texas. Write quickly, Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

Have several Drilling Blocks in Vinton, Jackson, Gallia, Lawrence, Hocking County, Ohio, also West Virginia acreage to farm out. Capital needed to drill, offset production.

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Parkersburg, West Virginia
Phone HU 5-6446

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OIL & GAS EXPLORATION
Beecher Hotel Bldg., Somerset, Kentucky
Phone: 650

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THE OIL AND GAS JOURNAL
P. O. Box 1260—Tulsa 1, Okla.

MONEY RAISING

NEED CAPITAL to drill 160 acres, direct offset to new Bartlesville Sand well. Primary production 775-ft. deep. Reply P. O. Box 8, Cherryvale, Kansas.

IF you change your address

please be sure to let us know promptly. It takes time to correct the stencil addressing plate. And we don't want you to miss copies of THE JOURNAL.

Also . . . . . .

be sure to give us both

(1) your OLD address

(including company)
and

(2) your NEW address

We need them both to make the change. Also confirmation of your company connection and position.

The Oil and Gas Journal

Box 1260 Tulsa, Okla.

LEGAL

SALE OF OIL AND GAS MINING LEASES TRIBAL INDIAN LANDS SALE No. 10. Department of the Interior, Bureau of Indian Affairs, Crow Indian Agency, Crow Agency, Montana. An oral auction will commence at 2:00 o'clock P.M., Mountain Standard Time, June 13, 1960, at the Office of the Crow Indian Agency, Crow Agency, Montana, for the leasing of 5 units of unsurveyed tribal lands comprising approximately 3,200 acres more or less in T. 6 S., R. 25 E., Big Horn County, Montana, for oil and gas mining purposes. The details of the lease offering and information may be obtained by addressing the inquiry to the Superintendent of Crow Indian Agency, Crow Agency, Montana.

LEGAL

SALE OF OIL AND GAS MINING LEASES TRIBAL AND ALLOTTED INDIAN LANDS SALE NO. 11. Department of the Interior, Bureau of Indian Affairs, Crow Indian Agency, Crow Agency, Montana. Sealed bids will received until June 13, 1960, 2:00 o'clock, P.M., Mountain Standard Time, and opened at that time in the office of the Crow Indian Agency, Crow Agency, Montana, for the leasing of 15,559.94 acres of tribal land located in T. 5 S., R. 26 E., T. 5 S., R. 27 E., T. 6 S., R. 26 E., T. 5 S., R. 25 E., and 20,007.43 acres of allotted land located in T. 5 S., R. 26 E., T. 6 S., R. 26 E., T. 5 S., R. 25 E., Big Horn County, Montana, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of Crow Indian Agency, at Crow Agency, Montana.

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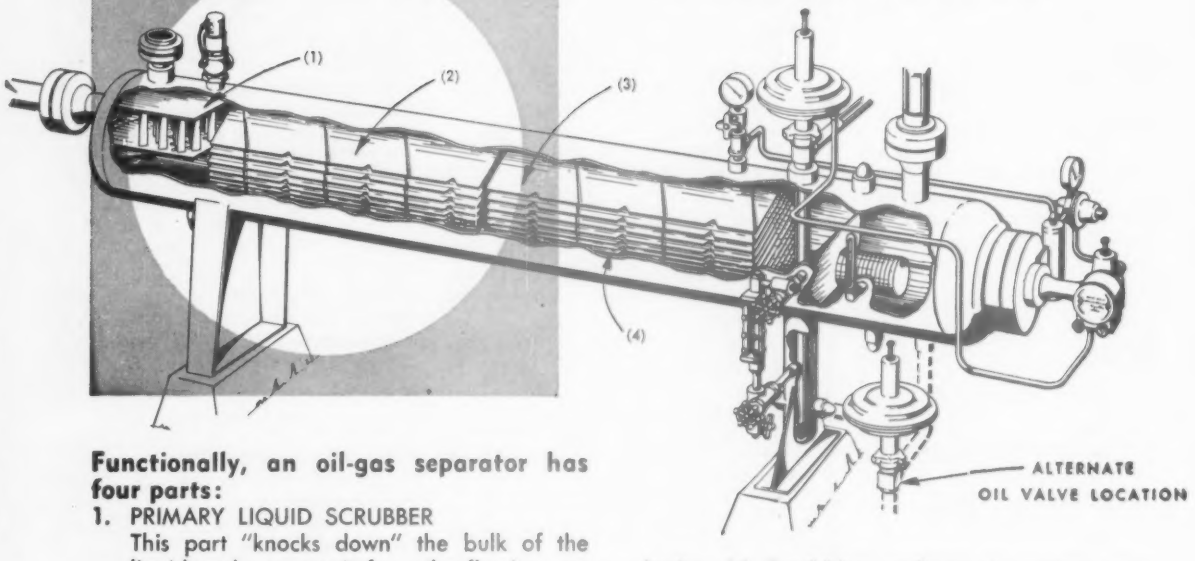
NATIONAL® MONOTUBE® SEPARATORS



Functionally, an oil-gas separator has four parts:

1. PRIMARY LIQUID SCRUBBER
   This part "knocks down" the bulk of the liquid and removes it from the flowing gas stream immediately.
   National's present design is the result of field tests using full scale operational models which utilized numerous scrubbing elements. From these tests National's present design was found. Today, when you buy a National MONOTUBE Separator, you buy experience, not experimentation.
2. MAIN GAS SCRUBBER
   Also as a result of these tests, proper spacing and length of Main Gas Scrubber plates was discovered, so as to effect the greatest liquid removal from the gas stream.
3. FINAL GAS SCRUBBING
   The multiple field tests with flanged components dictated our design. National's "straight-vane" design accomplishes final liquid removal without the use of "excelsior-like" elements which are prone to be plugged with waxes, sands and other extraneous materials, including hydrates inherent in the normal oil-gas and distillate production operations.
4. OIL DE-GASSING COMPARTMENT
   What effects oil de-gassing? (a) Length of time in compartment. (b) Surface area of oil body. (c) Scrubbing surfaces to remove entrained gases. When (a), (b) and (c) are at a maximum, oil de-gassing is best. National's full-scale field testing found the proper ratios.

NON-FREEZE VALVE

A field-proven, non-freeze liquid valve, particularly useful on high gas-oil ratio wells where entrance temperatures are near hydrate point. Ask your National man about this exclusive feature.

It's a National®

NATIONAL TANK COMPANY

TULSA, OKLAHOMA

HOW MANY PROGRESSIVE IDEAS CAN YOU SPOT AT THIS DOWELL FRAC JOB?

Fracturing has come a long way in the past 10 years. And new ideas continue to improve this method of well stimulation. Pictured above are just four of the contributions Dowell has made to help you get more oil through better fracturing. *Allison aircraft engine-powered pumpers*—compact, powerful. *Remote control panels*—for safer, exacting control of the job. At the well, the special *frac header*—for more safety, efficiency. The new *radio helmets*—for even better control of the job. Not shown, but also important: *Abrasijet,** abrasive perforating service—to reduce breakdown pressures; and the *"Frac Guide"** —for really precise engineering of treatments. New ideas . . . more for your money . . . *dial Dowell.* Dowell, Tulsa 1, Okla.

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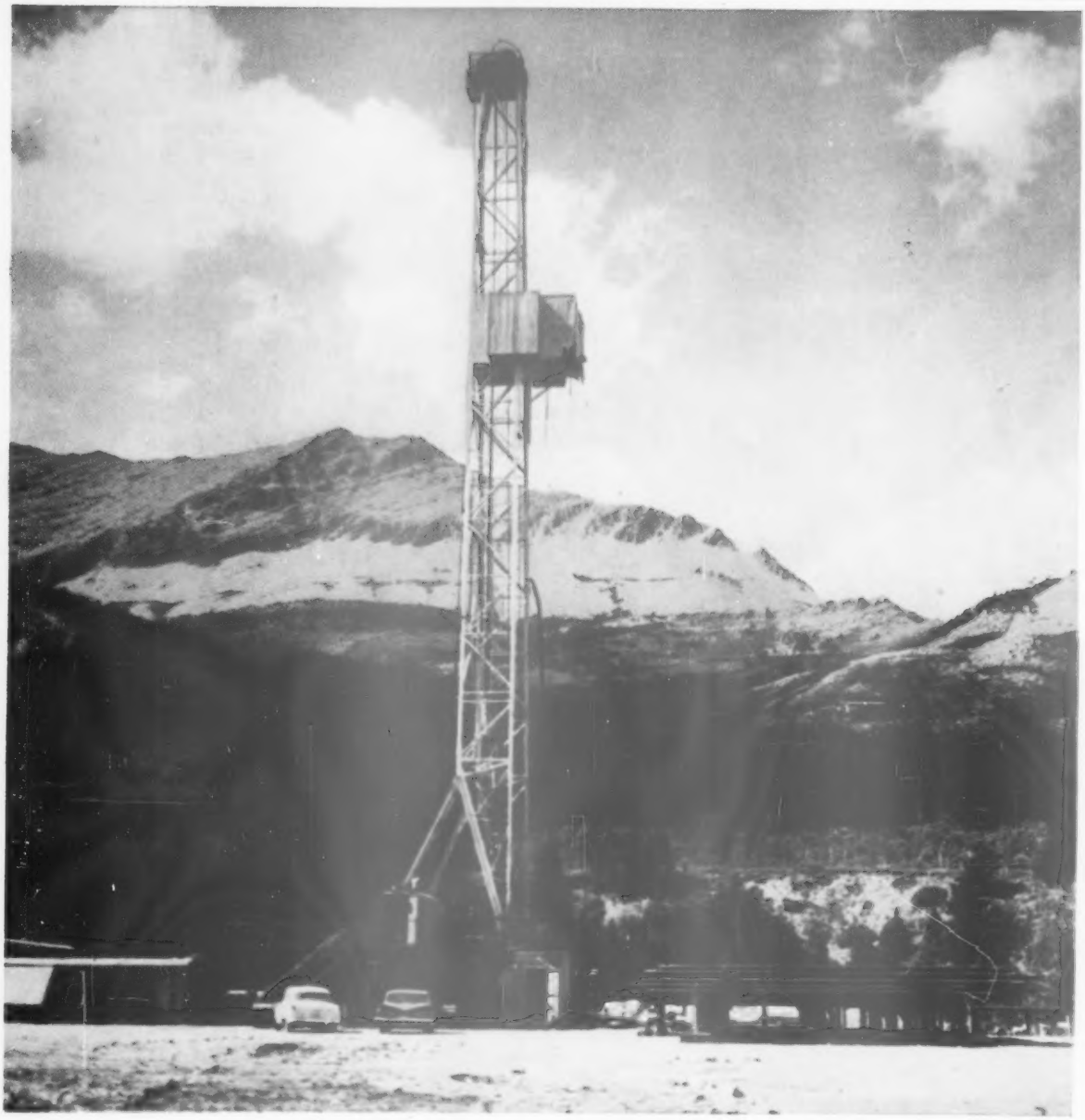

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